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ELECTRICAL TERMINOLOGY.

On another page of this issue will be found a list of definitions submitted by the Committee on Terminology of the National Electric Light Association. The committee does not submit these as final conclusions, but states that the list is offered for discussion and modification.

It is a relief to know that this is not a final report. And it is not surprising to learn that the report does not receive the unanimous support of the committee which has elaborated it. The definitions have not the finish which should mark a final report. There are many places in which the wording could be improved, and a few in which there is inherent evidence of some progress having already been made in the evolution toward a definition which shall meet with general satisfaction, for example, rotor and stator.

The list contains some terms that were better omitted; such are those commonly defined in dictionaries, and which cannot well be misunderstood, as *fuse* and *insulator*; those whose meaning is self-evident, as *low-tension* and *power-factor indicator*. Other definitions are woefully inadequate or at variance with usage, such as *flaming-arc lamp* and *high frequency*.

The principal object of such a set of definitions as these is to obtain uniformity in the usage of expressions that may at present be used with different significations; to limit a general term to a specific purpose; to distinguish by technical distinctions between terms now used synonymously or loosely, and to confine the designation of a particular thing to a single expression. In cases where present usage is widely diverse, great care should be exercised to sound popular sentiment and the widest consensus of opinion be gathered. For if general allegiance to an adopted definition is not secured, the code is worse than useless. Moreover, where definitions have already been adopted by some other body, such as the American Institute of Electrical Engineers, new definitions should not be adopted which would lead to conflict, but only when they might narrow the use of a term in accord with the present trend of practice.

The committee has a difficult task in hand, but its work, if thoroughly done, will be of lasting benefit. An example of the difficulties is shown in the definition of off-peak rate. In this definition the term *peak load* is used in a sense other than the quantitative one in which it is itself defined.

SMOKE PREVENTION.

It is a well-known fact that ordinary boilers which will operate almost smokelessly when using anthracite coal, usually become great offenders against anti-smoke ordinances when fired with bituminous or semibituminous coals; but it is not so well known that nearly any boiler can be made practically smokeless, no matter what kind of fuel is used, provided certain precautions are taken in the regulation of combustion.

When a fuel is used that will emit volatile products in burning, smoke is certain to result if these products are permitted to condense before they have a chance to become quickly oxidized or burnt up. This fact has been recognized for at least a decade and many ingenious arrangements have been devised to prevent such condensation and to facilitate complete combustion. One of these, which is worthy of more than passing attention, was described by Mr. H. A. Storrs in an article published in a recent issue of the Bulletin of the Denver Company Section of the National Electric Light Association.

The boiler which Mr. Storrs described was one used in constructing a Government project in North Dakota, where electricity is used for pumping water for irrigation purposes. The fuel available was lignite containing forty per cent of moisture. The ash pit of the boiler was closed, and air was delivered under pressure by steam-jet blowers. Another method of forced draft, besides that through the ash-pit, was also adopted. In this latter case, however, the air was preheated by being first passed through heaters located in the breeching of the stacks, and was thus delivered to the combustion chamber at a temperature of about 200 or 250 degrees. The immediate result of this preheating, not counting the gain in efficiency in utilizing part of the heat of the waste gases, was to prevent chilling of the volatile products in the combustion chamber, and practically smokeless operation of the boiler was thus effected. The heated air was passed into the furnace under pressure through the ports in the bridge wall and in the arch which was sprung over the fuel bed. The boiler was of the Stirling water-tube variety, and was well adapted for this method of operation.

There are probably many boilers in the country which could be modified to make use of the same idea as that developed by Mr. Storrs, and any plant operator using fuel containing a large percentage of volatile matter would do well to investigate along similar lines.

Another excellent contribution bearing on this question of boiler efficiencies and smoke prevention is Bulletin No. 34 of the University of Illinois Engineering Experiment Station. This publication deals with the question of combustion in steam boilers and shows that with a partially cooled furnace and combustion chamber, excellent combustion conditions may be maintained so that the overall boiler efficiency may even be increased without making any appreciable or objectionable smoke.

Apart from the questions of boiler efficiency and of general cleanliness, operators of electric generating stations who make successful efforts to minimize smoke emission from their stacks will tend to prejudice an aesthetic and observing public in their favor, besides setting an example to operators of neighboring, nonelectric plants, and preventing an embarrassing visit from the anti-smoke inspector.

TO THE COLLEGE GRADUATE.

To the college graduate about to enter actively into electrical engineering we give greeting. The college student is habituated to receiving advice, and especially at this time is likely to be surfeited with it, but we wish to take advantage of the general privilege of administering yet a little more.

To the engineering graduate we would say then, enter the shop. The shop is usually the least attractive of the openings which are available to the embryo engineer. The hours are sometimes long, the work is dirty, and the pay at the beginning is usually poor. The office of a consulting engineer, the designing or drafting room of a manufactory, or the testing room of the works looks much more attractive. The unpleasant features of shop work are lacking, and moreover there will be opportunity to apply some of the knowledge which he has been absorbing, and to absorb more of the same kind. He will be surrounded by a more congenial atmosphere, by more men of his own kind.

But these are the very things he should avoid. A college education leaves a man deficient in certain things which the engineer must know, and they can be learned nowhere so well as in the shop. The contact with workmen and their ideas and points of view, the details of shop organization, operation and practice, the familiarity with shop conditions of every kind, will be most helpful factors in the future advancement of the engineer. The college graduate must learn to serve, to make himself useful, to obey orders.

We have used the word shop in a broad sense, as the place where the manual labor is done. In a central station, for instance, the engine room takes its place. With the operating telephone company, the line-man is doing similar work. The essential thing is to learn how to do, and not to know merely what ought to be done.

The plan of the University of Pittsburg to include one year of shop work in the engineering course through co-operation of local manufacturers is an excellent one and should supply their students with an equipment which the graduate usually lacks. The shop training is probably more valuable before entering college than after leaving, but even after graduation it is not too late to begin and we repeat our advice to the young graduate—enter the shop.

DIRECTIONAL WIRELESS AND SEA FOGS.

According to a press report emanating from New York, the French liner *La Provence*, which in common with other vessels of the same steamship company is equipped with a directional system of wireless telegraphy, was enabled on a recent voyage from Havre to New York to keep apprised of her location relative to other vessels by means of her wireless apparatus. One of the officers of the vessel is reported to have said, "If this system is generally adopted we shall have mastered the fog at last."

While the French officer's statement is a little too positive for the small fishing and other vessels so frequently encountered near places like the Banks of Newfoundland could hardly be expected to be equipped with a comparatively expensive wireless installation, still there is reason to record the above as yet another triumph of wireless telegraphy and an advance over previous methods of safeguarding lives and valuable property at sea.

The modus operandi is to send out wireless signals of given wave length and intensity, which can be picked up by vessels in the vicinity which have wireless receivers adjusted so that the intensity and direction of the waves are determinable, thus permitting the establishment of the approximate position of the signaling ship. The same method would also seem to be useful in quickly locating disabled vessels, although ordinary nondirectional systems of wireless telegraphy have proved efficacious on similar, notable occasions.

En passant, it may be worthy of suggestion that the wireless equipment may yet be made to serve a further useful purpose. It will be remembered that Sir Oliver Lodge, the well-known English physicist, demonstrated some time ago that a high-tension discharge from a conductor into the air has the effect of clearing a fog in a well-defined area around the conductor. Would it not then be possible to utilize the wireless apparatus, directly or in a modified form, to intensify this effect, and so create a zone of safety for ships in a fog at sea when perchance they are so close together that even the directional wireless system would cease to be of material value?

THE NATIONAL ELECTRICAL CREDIT ASSOCIATION.

On another page of this issue there is a modest item relating to the eleventh annual meeting of the National Electrical Credit Association. While nearly every representative manufacturer in the electrical industry knows incidentally of the remarkable work of this association, it is only when aggregate figures are analyzed that the value of the organization to the business can be estimated. During last year the total number of items handled aggregated 50,671, and the aggregate amount of settlements adjusted made a total of $2,603,628.72. This is a fine showing and the officers, and particularly the efficient secretary and treasurer, are entitled to our heartiest congratulations.

ELECTRIFICATION OF STEAM ROADS.

The Government of Sweden has inaugurated a policy of operating the State railways electrically, the current to be furnished by hydroelectric power-stations. An equipment is now planned for operating a road on the Finnish border, and if this is successful the extension of electrification is to be pushed to all parts of the realm.

Sweden, like Norway and Finland, is well situated for a development of this kind. The available waterpowers are sufficiently well distributed over the country to make transmission feasible to all districts, and moreover the water supply is regular.

We recommend to the railroad magnates of this country a study of the conditions which make it possible, in a country of sparse population, to inaugurate a change in motive power which seems impossible to so many of the railroads in this country. It is true that most of the roads in this country could not obtain power so cheaply as in Sweden. But the power cost is not usually so much of a deterrent as the cost of installation.

In a country which boasts of so much enterprise as ours it is surprising that electrification is not being adopted at a more rapid rate, especially where suburban traffic is heavy. While it is true that New York has achieved the change on all roads entering that city, and some of our other cities have seen certain lines electrified, it must be admitted that certain other large cities, such as Chicago, are exceedingly backward in this respect. At least three of the steam roads with terminals in the latter city have heavy suburban traffic and one of them has moreover been ordered by the city to make the change, and yet no progress is visible toward this end.

A TRUE PHILANTHROPIST.

A refreshing instance of true philanthropy appears in the "Record of Electrical Patents," published at the end of the reading columns of this issue. Patent No. 960,823, entitled "Indicating and Measuring Device for Use in Mines or Wherever Desired to Detect Presence of Combustible Gases," by Mr. Harold H. Clark, Pittsburg, Pa., is "dedicated to the public."

Here is an inventor who has apparently not only spent his time, energy and money in perfecting a device calculated to prevent loss of life and property due to explosions in mines, etc., but has himself gone to the expense of patenting his invention so that all may be freely permitted to use it.

Regarding the worth of the invention we know nothing at this present time, but the example set by Mr. Clark is worth recording and following. A human life is more valuable than a mere piece of property, and legislation making compulsory the use of devices designed to safeguard workers in every field should be encouraged.

Western Utility Companies in Merger.

With the incorporation, under the New York state laws, of the Federal Light and Traction Company, with a nominal capitalization, the merger of various utitlity companies in Colorado, New Mexico and Wyoming is practically completed.

Capitalization of the Federal Company will consist of $5,500,000 six per cent cumulative preferred stock, $2,500,000 of which will be issued immediately, and $5,500,000 common stock, of which $4,500,000 will be issued.

Companies that will be included in the merger when completed include the following: Grays Harbor Railway and Light Company of Aberdeen, Wash.; Sheridan Electric Light and Power Company, of Sheridan, Wyoming; the Rawlins Electric Light and Fuel Company, of Rawlins, Wyoming; the Montrose Electric Light and Power Company of Montrose, Cal.; the Hobart Light and Power Company, of Montrose, Cal.; the Albuquerque Gas, Electric Light and Power Company, and the Albuquerque Electric Power Company, both of Albuquerque, New Mexico; the Las Vegas Light and Power Company, and the Las Vegas Transit Company, both of Las Vegas, New Mexico; the Tucson Gas, Electric Light and Power Company, and the Tucson Rapid Transit Company, of Tucson, Ariz.

Gross earnings of the above companies for 1909 amounted to $697,157, compared with $563,062 for 1908. Expenses in 1909, including maintenance, depreciation and taxes were $465,292, against $442,787 for the previous year, giving a net of $231,865 for 1909, compared with $210,275 in 1908.

In speaking of the company's prospects, an officer says:

"The companies serve without competition a combined population in excess of 105,000. The cities are enterprising, substantial in character, diversified as to location and interests, and their future growth and prosperity are assured. The properties are modern and their physical condition is superior to that of the majority of other properties of similar size."

Church Lighting.

The London *Electrician* states that St. Matthew's Church, Bolton, England, is to be lighted by electricity.

National Electrical Credit Association.

The eleventh annual meeting of the National Electrical Credit Association was held June 9, 1910, at the Clifton Hotel, Niagara Falls, Canada, and was attended by the representatives of the New England Electrical Credit Association, the Electrical Credit Society of New York, the Electrical Credit Association of Philadelphia, the Electrical Credit Association of Chicago and the Electrical Credit Association of the Pacific Coast.

The reports indicated that the association had passed through a year of substantial growth and splendid accomplishments. The total number of items handled aggregates 50,671, and the aggregate amount of settlements adjusted totals $2,603,628.72.

The membership of the National Association now numbers 431 of the representative manufacturers and jobbers in the electrical trade, from the Atlantic to the Pacific and from the Lakes to the Gulf.

The officers for the ensuing year are: President, Chas. C. Hillis, Electric Appliance Company, San Francisco; vice-president, A. L. Miller, John A. Roebling's Sons Company, New York; secretary and treasurer, Frederic P. Vose, Chicago.

San Francisco was fixed upon as the place of the next annual meeting, to be held June 8, 1911.

Street Railway Development.

The remarkable development, since 1902, of the industrial activities of the street and electric railways of the United States is clearly seen in the statistics compiled by the Census Bureau from the census of such companies, taken in 1907, and presented in its second report, now being distributed.

An interesting feature of the report is the comparative summary for 1907 and 1902, in which it is shown that the total number of operating and lessor companies in the United States in 1907 was 1,236 and in 1902, 987, the per cent of increase being 25.2.

In 1907 the total number of miles of line, by which is meant length of first main track or roadbed, was 25,547.19, as compared with 16,645.34 in 1902, the per cent of increase being 53.5. The total number of miles of track, meaning the total length of all trackage, including sidings, was 34,403.56 in 1907, as against 22,576.99 in 1902, the per cent of increase amounting to 52.4. Of the total number of miles of track, those operated by electricity in 1907 numbered 34,059.69 and in 1902, 21,907.59. In other words, electricity now forms ninety-nine per cent of the motive power of all street railways.

Chicago Electric Club.

At the June 8 meeting of the Chicago Electric Club, H. B. Gear, of the Commonwealth Edison Company, Chicago gave a comprehensive resumé of the proceedings of the recent convention of the National Electric Light Association at St. Louis, Mo.

Mr. Gear, first presented statistics of an interesting nature, relative to the Association's history. He outlined the general conditions at the St. Louis convention and called attention to the active interest manifested by all present, in every phase of the meeting. He then gave a brief summary of each session, pointing out the significant points, and in the case of a few of the important papers gave brief abstracts of the points emphasized by the authors.

At the conclusion of Mr. Gear's remarks A. A. Gray called attention to the excellent representation of Chicago at the convention, particularly the delegation of 100 Commonwealth Edison employes.

Following this Mr. Gray, as chairman of the House Committee announced that a definite announcement would be made in the near future regarding the return of the club to its former quarters.

Waterpower in New Zealand.

The Government of New Zealand will shortly ask Parliament for $2,433,250 to be spent in developing the colony's water power resources. Names of dealers in electrical and power equipment in New Zealand can be obtained by interested firms from the Bureau of Manufactures, Washington, D. C., quoting File No. 5046.

Cheap Electric Power.

What is said to be the cheapest power-rate in the world is enjoyed by the users of electricity at Harrisonburg, Va., where power is supplied for two-fifths of a cent per kilowatt-hour. The plant which furnishes this power is a hydroelectric installation and is municipally operated.

Pittsburg Electric Booster's Club Outing.

The Pittsburg Electric Booster's Club will have a grand outing at Bradford Woods on June 25. The tickets, including the trip from Pittsburg to Bradford and return, are $1.50, and include all the privileges of the annual outing.

The Boosters Club has been carrying on a very active campaign for the last two years in Pittsburg and vicinity, and there has been formed a nucleus for a strong, influential organization. The membership is composed of the most representative men in the electrical industry in Pittsburg and adjoining towns, and it is expected that the outing will be largely attended, and that a thoroughly enjoyable time will be had.

Immediately after the outing steps will be taken to effect a permanent organization, a committee having been appointed to consider the compilation of constitution and by-laws, and the appointment of committees for carrying on the routine work of organization.

The Master Controller of the Pittsburg Electric Booster's Club is C. B. Cushing, who is associated with Frick & Lindsay Company, and the Recording Wattmeter is A. G. Pierce, manager of the Pittsburg office of the Cutler-Hammer Manufacturing Company.

Alabama Power Projects.

Captain R. H. Cobb, of Anniston, has applied for a franchise to operate an electric power project at Gadsden, Ala. He will build a dam at lock No. 2, on the Coosa River, and expects to generate at least 25,000 horsepower. The Southern Iron and Steel Company has signed a tentative contract for 12,000 horsepower and the Dwight Manufacturing Company for 3,000 horsepower.

The Canadian government has decided to allow 3,500 horsepower of electricity to be exported to Minnesota by a company which has developed power at Fort Francis, on the Rainey River.

Hugo Reisinger.

The subject of this sketch is not only well-known in electrical and scientific circles, but he is a figure of great prominence in arts and letters, and so far as mortals go has come in contact with kings and principalities, and has come away each time with something that is treasured among kingly possessions.

Mr. Reisinger is probably best known to electrical men as the importer of carbon products, and it may be said without fear of contravention that his importations are good ones.

HUGO REISINGER.
A Leading Importer and a Prominent Patron of Arts and Sciences.

Hugo Reisinger was born in Weisbaden, Germany, January 29, 1856, the son of Dr. Franz Reisinger, who was well known as a literary man, and as an owner of a newspaper of that town. Hugo Reisinger received his early education at the Weisbaden Gymnasium (grammar school and college) and received his first business training in Germany. He traveled in America during 1884 and 1885, and established his business here on April 1, 1886. During the St. Louis World's Fair Mr. Reisinger was honorary commissioner to Europe for the World's Fair.

Mr. Reisinger has been interested in art matters all his life, and in 1909 arranged the German Art Exhibition in New York at the Metropolitan Museum of Art; in Boston at the Copley Society, and in Chicago at the Art Institute. This year Mr. Reisinger arranged the American Art Exhibition in Berlin at the Royal Academy, and in Munich at the Royal Art Society.

The purpose of these art exhibits was to assist in furthering an exchange of art between the two great nations and thereby achieve a still better understanding between them. The matter was absolutely philanthropic on the part of Mr. Reisinger and no business whatsoever was connected with the enterprise, all expenses having been borne by him personally, and there being no income whatsoever derived therefrom.

Mr. Reisinger has been decorated by the German Emperor with the Commanders Cross of the Prussian Crown, and by the Prince Regent of Bavaria with the Commanders Cross and the Star of the Order of St. Michael. He has been appointed honorary fellow of the Metropolitan Museum of Art for life by the trustees, the certificate being presented to him by J. P. Morgan as president of the board. He owns the best collection of German art in the United States, and is a member of the Metropolitan Museum of Art, the National Arts Club, the Deutscher Verein, Garden City Golf Club, and Riders and Drivers Club.

Extension of Taylors Falls Power Plant and Transmission Lines.

The St. Croix Falls Improvement Company has arranged with the Stone & Webster Engineering Corporation for an increase in the capacity of the Taylors Falls Plant which supplies the city of Minneapolis.

The present power station building, which, with the dam built in 1906, will be extended to accommodate two new 2,500-kilowatt units with exciters and step-up transformers, thus increasing the total rated capacity of the installation to 15,000 kilowatts.

ELECTRIC FURNACE PROGRESS.

OFFICIAL LIST OF HEROULT FURNACES.

Reports from continental Europe and England, says the *Iron Trade Review*, are to the effect that a number of steel works in addition to those now pursuing this practice are planning the installation of the electric steel-making process and that the Héroult type of furnace is being adopted much more rapidly there than in the United States. In England plans are under way for the installation of five or six additional Héroult furnaces, some of them to be especially large and of twenty tons capacity.

Recent publication of the list of Héroult licenses issued has been inaccurate and the official statement of the patentees in this regard which shows in all forty-two furnaces finished, under construction and projected embraces the following works:

Works of August Thyssen—Deutscher Kaiser Stahlwerke, Bruchhausen, Germany, and Deutscher Kaiser Stahlwerke, Muhlheim, Germany.
Stahlwerke Richard Lindenberg, Remscheid-Hasten, Germany.
Bismarckhutte, Upper Silesia, Germany.
Mannesmann-Rohren Werke, Saarbrucken, Burbach, Germany.
Kaernthner, Eisen & Stahl Werke, Austria.
Gebr. Bohler & Cie., A. G. Kapfenberg, Austria.
Georg Fischer, Schaffhausen, Switzerland.
Soc. Electromet. Francaise, LaPraz, Savoie, France.
Acieries du Saut du Tarn, St. Jury, France.
Aktiebolaget Heroults Electriska Stal, Kortfors, Sweden.
Societa Tubi Mannesmann, Dalmine, Italy.
Bruder Lapp Rottenmann Works, Steiermark, Austria.
Imperial Steel Works, Obuchow, St. Petersburg, Russia.
Usine Metallurgique de la Basse Loire, Trignac, France.
Soc. des Usine Metallurgiques de Hainaut, Coulliet, Belgium.
Edgar Allen and Company, Sheffield, England.
Thomas Firth and Sons, Ltd., Sheffield, England.
Skinningrove Iron Company, Ltd., works Carlin How, Yorkshire, England.
Vickers Sons & Maxim, Ltd., works Sheffield, Barrow, Birmingham, England.
United States Steel Corporation.
Halcomb Steel Company, Syracuse, N. Y.
Firth-Sterling Steel Company, McKeesport, Pa.
Crucible Steel Company of America, Pittsburg.
Cia. Mexicana di Acero y Productos Chemicos, Mexico.

Electricity for Rawhide, Nev.

The Hydro-Electric Power Company, of Bodie, Cal., will shortly begin the construction of a transmission line into Rawhide, Nev., to supply light and power to that camp.

Census Report on Telephones.

The Census Bureau is issuing a report on the 1907 census of the physical equipment, service and financial operations of telephone companies.

The total number of systems and lines was 22,971 and the miles of wire almost 13,000,000. The employees numbered 144,169, and the salaries amounted to over sixty-eight million dollars. The capital stock and funded debt was $12,316,109.

As compared with the census of 1902 this shows an increase in systems of 151 per cent, in miles of wire of 165 per cent, in employees of 83.0 per cent, in wages of 85.6 per cent, in capital stock of 134 per cent, in income of 112 per cent.

The industry is largely concentrated in the populous North Atlantic and North Central States, and the greatest amount of increase between 1902 and 1907 in wire mileage, telephones, and business is shown for them.

More rapid rates of increase occurred in other sections, however, and the largest percentages of gain for wire mileage are shown for the Western, South Central, and South Atlantic States, where, as a rule, the telephones are farther apart than in the other divisions. The Western States had the largest percentages of increase also in the number of telephones and talks.

The number of telephones, the report states, is probably the most satisfactory measurement by which to determine the relative importance of different companies. Including the farmer or rural lines, the Independent owned 44.4 per cent of the total number of telephones in 1902 and 48.8 per cent in 1907.

The report was prepared by W. M. Steuart and T. C. Martin with the assistance of F. H. Reed and S. B. Ladd.

Commission News from New York.

The New York Public Service Commission, Second District, has authorized the Fulton County Gas and Electric Company to issue its three-year, six-per-cent gold notes, dated March 1, 1910, for the aggregate principal sum of $99,000. The notes are to be sold at par and accrued interest, and the proceeds are to be used for the construction of a transmission line from the power station of the Mohawk Hydroelectric Company in Ephratah to the station of the Fulton County Gas and Electric Company in Gloversville.

The commission has authorized the Geneva-Seneca Electric Company to execute a mortgage to secure bonds to the amount of $750,000 instead of $500,000, as it is believed that said company will be required to expend a larger amount of money than was heretofore contemplated by reason of the purchase of the property, rights and franchises of the Economic Power and Construction Company.

The commission has also authorized the Conant-Bryant Power Company to begin construction and exercise franchise in the town of Wilson, Niagara County, and also authority to issue its stock to the amount of $25,000, the proceeds to be used for the purchase and installment of an electric plant and power house with necessary equipment and necessary lines in the village.

The commission has allowed the withdrawal of the applications of the Ithaca-Auburn Power Company, without prejudice to the making of new applications. The company, which is a newly organized one, proposed to issue its common capital stock to the amount of $350,000, of which $250,000 was to be issued to the Remington Salt Company and $100,000 to the Ithaca Street Railway Company. The withdrawal of the applications is due to the fact that the commission considered the plan to be wholly in contravention of section seventy of the Public Service Commissions Law which will not permit the issue of more than ten per cent of the capital stock of the Ithaca-Auburn Company to the Remington Salt Company and more than ten per cent of the same stock to the Ithaca Railway Company.

Trolley Enterprise in Asia.

A report has been received at Washington, D. C., from an American embassy in an Asiatic country inclosing four copies of the conditions proposed by the local Ministry of Public Works in regard to the construction of electric street-car lines over a considerable portion of the suburban districts of a certain city. Tenders may be submitted until November 10, 1910. Copy of the conditions can be obtained by interested firms upon application to the Bureau of Manufactures, Washington, D. C., quoting File No. 5059.

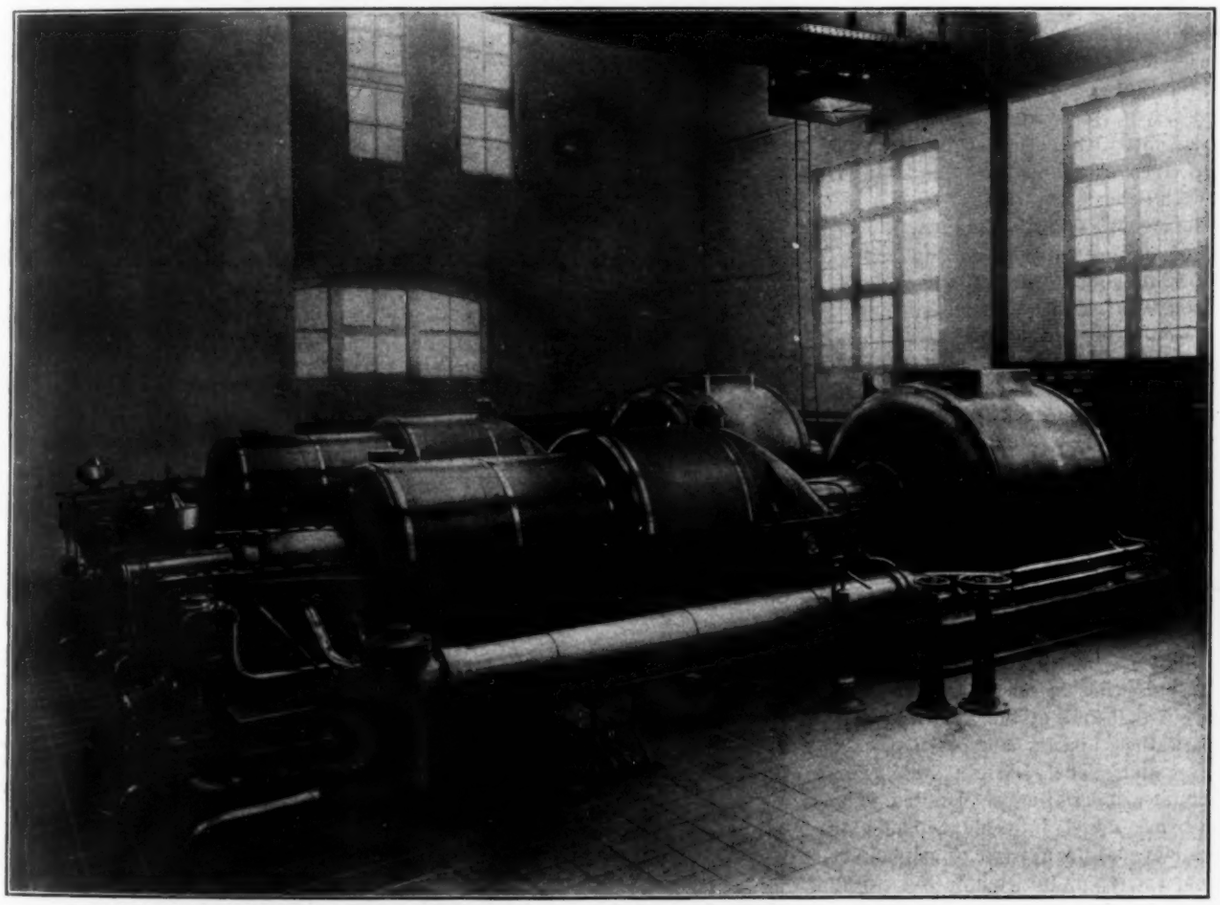
Electricity in Leather Manufacturing.

An Illustrated Description of the New Power Plant of the Pfister & Vogel Leather Company, Milwaukee, Wis.

BY FRED S. SLY.

The Pfister & Vogel Leather Company of Milwaukee, Wis., has recently completed a new power plant which is a model of many desirable engineering ideas. This company is the largest leather manufacturer in the world and its buildings cover considerable area. They are located on the west side of First Avenue and for the most part to the south of the Menominee River, although some are to the north. Formerly power for different operations in the work was obtained from lineshafts; but more recently there has been a change to individual electric-motor drive, and to make this as practical and efficient as possible was one of the reasons leading to the building of the new power plant, which, it is figured, will show a saving of about $60,000 per year.

The site selected for the power house is centrally located but rather restricted in area. Consequently it was necessary to utilize all available floor space, although no restrictions were placed on headroom. The plant is close to the river, which provides for an abundant supply of condensing water. The building is sixty-two by 135 feet and is built not only for usefulness but also with some regard to its appearance. The foundation is of concrete, while the superstructure is of red pressed brick with stone trimmings. There is a basement under the entire building. The main floor is divided into two sections by a heavy brick wall, the southern half being for the boilers, while the other section houses the turbines and electrical apparatus. The walls of this room are finished throughout with white tile, except for a five-foot wainscot of green tiling. A red tile floor adds to the finish of the interior and makes it easy to keep clean. In one corner of the engine room rises the stack, which is twelve feet internal diameter and 285 feet high. This location was chosen because of lack of room elsewhere. The stack is of Wiederholt tile concrete construction and is well protected with lightning rods. The turbine room is



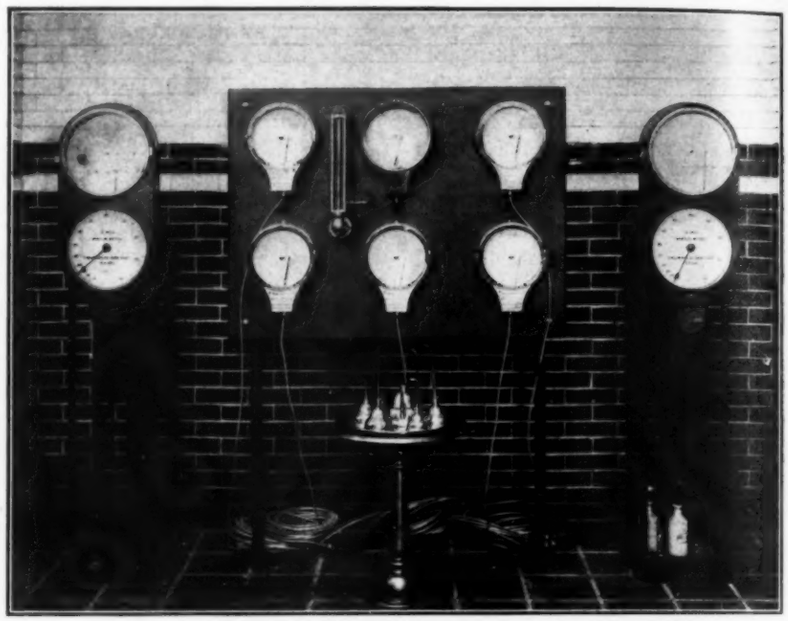
STEAM TURBINES AND SWITCHBOARD IN POWER PLANT OF PFISTER & VOGEL LEATHER COMPANY.

spanned by a ten-ton Pawling & Harnischfeger crane driven by a direct-current motor.

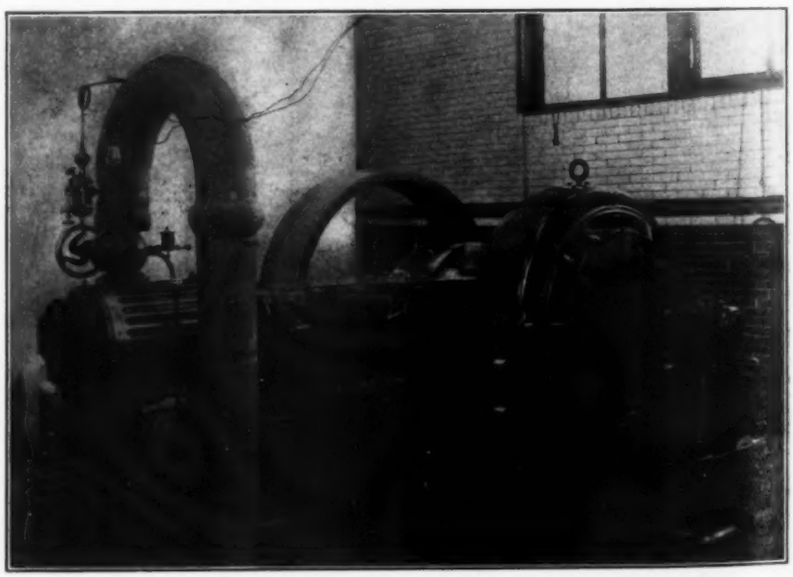
Coal, which is ordinarily Youghiogheny screenings, is delivered to the plant on a track close to the south wall of the building. It is dumped into a hopper beneath and at the side of the track from which it is delivered to a motor-driven crusher by a plunger feeder. From here it is carried by bucket conveyor to a steel-hopper storage-bin of eight-hundred tons capacity placed over a portion of the boiler room. Distribution is by means of a Bartlett & Snow six-ton movable weighing hopper. This is supported on tracks similarly to a crane and is operated by a six-horsepower alternating-current motor. Coal can be delivered by this from the storage hopper to any of the furnaces. Suitable weighing cards, requiring only punching, are provided so that the attendant can keep track of all the coal that is used by each boiler.

The steam generating plant will consist of six 585-horsepower Edge Moor boilers, having 5,850 square feet of heating surface each, arranged with three on either side of a central aisle. Three of these boilers are now in place and three others, which were part of the old equipment, will be transferred to the new power house. Each boiler is provided with a Green traveling-link grate twelve feet wide and ten feet long, having 120 square feet of grate area. Foster superheaters are used and furnish a superheat of 175 degrees Fahrenheit, steam pressure of 160 pounds. Vulcan soot-cleaners are used on all boilers. The cleaners result in a great saving in labor, a large economy in fuel and, at the same time, increase the capacity and efficiency of the boiler. The Darley system of vacuum ash-handling is installed. The ashes are raked into eight-inch pipe and elevated to a two-car ash-hopper from which a chute leads to the switch track already mentioned. The vacuum is maintained by an exhaust fan driven by a thirty-horsepower motor.

A sufficient supply of feed water is assured at all times. As far as possible it will consist of the condensation from the steam lines in the various buildings, this condensation being delivered by two vacuum pumps to receiving tanks in the basement of the boiler house. The placing of these shows the care that has been taken throughout the entire power plant to utilize available space. The foundations of all boilers are built with concrete walls leaving a large space inclosed. Under the south row of boilers this space has been utilized as a storage room, while under the north row of boilers it has been used to house the three steel receiving tanks mentioned. The extra water for the supply is ordinarily received from a water purifier mentioned later. An automatic valve admits this to the receiving tank when the water in it gets below a certain set height. In case no water is available from the purifier another automatic valve admits water from the city mains. The water from the receiving tank is fed to an open feed-water heater by duplicate sets of Fairbanks tank-pumps. This heater receives the exhaust from all auxiliaries. Duplicate sets of Fairbanks Morse twelve and eight by twelve inch outside-packed plunger-pumps are installed for feeding the boilers. These are fitted with governors which control the feed-line pres-

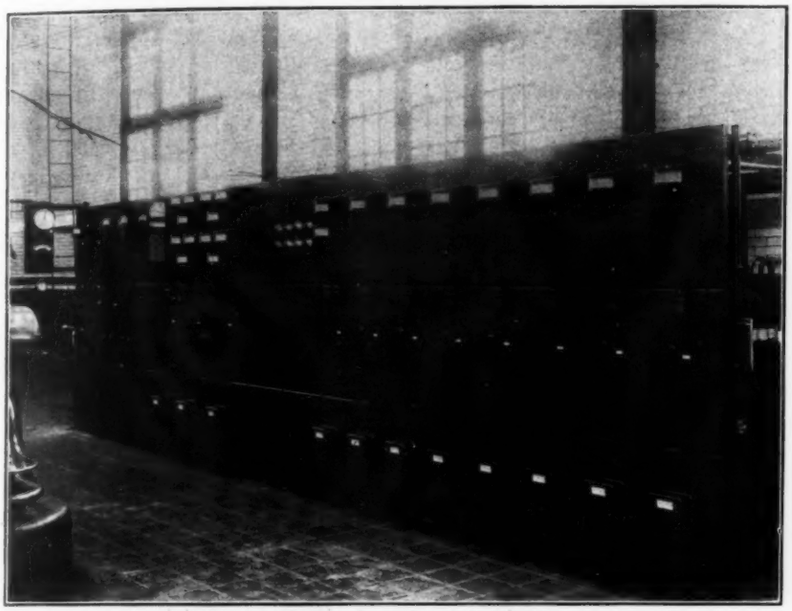


VENTURI METERS, PRESSURE AND TEMPERATURE GAUGES.

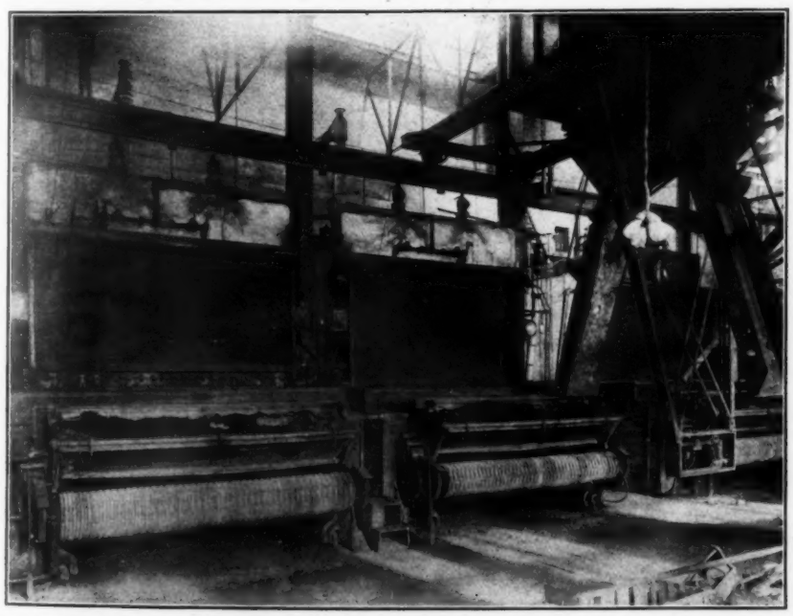


EXCITER SET AND GENERATOR IN PFISTER & VOGEL POWER PLANT.

sure, but no automatic feed-water regulators are used. The feed-water piping is arranged to be very accessible and also to prevent possibility of shutdown. This consists of two lines of heavy piping under the floor in front of each row of boilers. These are so arranged by cross connections and valves, that any or all boilers can be fed from either line and supplied by either or both pumps. In each line is placed a five-inch Venturi meter with its recording gauge located in the turbine room. With these the feed to all or any one boiler can be measured. This arrangement will permit of testing any single boiler or the plant as a whole. Two steam headers are placed back of each row of boilers, one above them and one beneath. These are connected at each end so as to form a loop and valves are so placed that practically any part of the loop can be cut out. Steam lines lead from these headers to the turbines and auxiliaries, and are carried beneath the floor.



SWITCHBOARD IN PFISTER & VOGEL POWER PLANT.



BOILERS, WEIGHING HOPPER, ETC., IN PFISTER & VOGEL POWER PLANT.

The generating equipment consists of two Allis-Chalmers 1,500-kilovolt-ampere, sixty-cycle, three-phase, 480-volt generators, which ordinarily run on an eighty-per-cent power-factor. These are connected to two 1,000-kilowatt turbines, running at 1,800 revolutions a minute, receiving steam at 160 pounds pressure, and discharging into a vacuum of twenty-eight inches referred to a thirty-inch mercury column. Space for a third turbine is provided to care for future extensions.

The separate condensers installed for each turbine are known as Tomlinson Type C. The selection of the proper sort of condenser was highly important, as the condensing water, taken from the river, is very dirty. The Menominee river, while fed from a creek, receives the discharge from numerous manufacturing establishments above the Pfister & Vogel plant so that when the water reaches the inlet of the condenser suction-pumps, it is in about as poor condition as could be found.

The condensers used are somewhat novel in design. The condenser head is a pear-shaped body, provided with a spray nozzle for the water, so arranged that the openings are not restricted. This prevents any clogging due to the extremely dirty water.

The pumping unit for each condenser consists of two single-stage centrifugal pumps of special design, mounted on the same shaft and driven by an eighty-five-horsepower induction motor. One pump takes water from the condenser head and discharges it into the hot well against atmospheric pressure. The other takes water from the cold well and discharges it through an air-ejector nozzle which is connected by suitable piping to the condenser head. This serves the purpose of the ordinary dry-air pump.

Two things are very impressive in this condenser installation. Each condensing unit occupies a very small amount of cubic space. The condenser head, pumps and motor driving them are located directly beneath the turbine and occupy no floor space outside the turbine foundation. The second item of note is the extremely good vacuum maintained under the poor conditions of operation with the dirty river water. The mercury column shows the condensers maintain a vacuum within 1.5 inches of absolute vacuum with injection water at about sixty degrees.

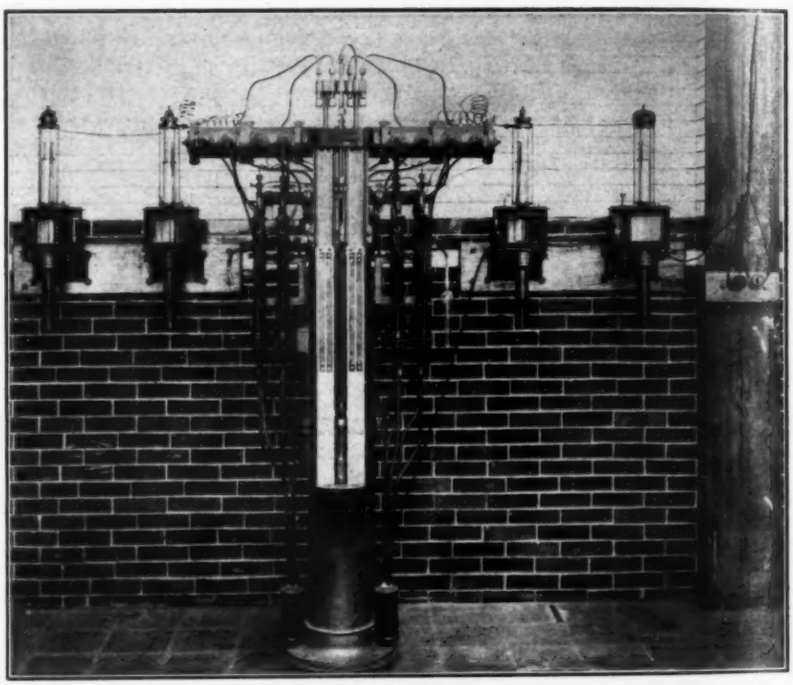
A great deal of water is required in the process of tanning, and it was found to be cheaper to purify the necessary supply than to buy it from the city. To accomplish this one of the largest water softeners ever built has been installed by the Kennicott Company. This softener will have a capacity of 150,000 gallons per hour and will receive its supply from the hot well of the condenser in which the water is cleaner than that obtained from the river. The water is also heated, which will assist in the process of softening. The water is delivered from the hot well to the softener by two De-Laval centrifugal pumps, one motor-driven and one driven by a De-Laval impulse turbine. A reserve Fairbanks-Morse pump is provided for emergency use. The tank of the softener is at a sufficient height to give gravity flow throughout the works. Two 1,500-gallon Fairbanks-Morse underwriters fire-pumps located in the basement provide fire protection.

In connection with the turbines a very unique scheme has been devised for furnishing the steam necessary for heating the buildings and carrying on the processes of manufacture. This consists in connecting a steam bleeder to an intermediate stage of the turbine and taking steam from it after the steam has accomplished a large amount of work. The pressure used in the heating and process steam lines is about five pounds gauge, so the connection is made to the turbine at such a point that at half load the pressure is five pounds. At higher loads a greater pressure exists at this point and a reducing valve is provided. A non-return stop valve is placed on the line so that steam from one turbine cannot find its way to the other. Six thousand pounds of steam per hour can be taken from the turbine without causing the opening of the auxiliary valve. This steam contains no oil and is particularly good on that account.

Two steam-driven exciters are furnished, either of which will furnish excitation to both alternators. One is a seventy-five-kilowatt Allis - Chalmers generator driven by a high-speed engine and the other is a 150-kilowatt impulse turbine set which is large enough to supply lighting current if necessary. An Allis-Chalmers motor-generator set will be installed for ordinary excitation service. The crane in the turbine room is operated by direct current, which can be furnished by the generating sets just mentioned and be in shape to work whether or not the main generators are running. All other motors throughout the works are 440-volt induction motors. The output of the generators is governed by a voltage regulator. A dull-finished slate switchboard at the floor level and at one side of the turbine room contains the controlling apparatus. This consists of General Electric remote-control oil switches, time-limit relays, Thompson recording wattmeters, voltmeters, and the necessary switches for controlling feeder and exciting lines. Lighting circuits are operated at 110 volts through three seventy-five-kilowatt transformers and by means of a double set of busbars on the board, may be thrown on the direct-current exciter units.

Along the south wall of the turbine room are placed a complete set of gauges for recording the operation of the steam plant in all its details. These include the gauges of the two Venturi meters previously mentioned, which show the volume of water being fed at any time and also have a totalizing dial which shows the consumption of water at any time. Recording steam, feed-water temperature, steam temperature and vacuum gauges, draft gauges and thermometers help to give a record which is completed by a Uhling carbon-dioxide continuous recorder. This recorder is also connected to an indicating gauge on the front of each boiler and the fireman can see at any time just what is the condition of his fire. This very complete apparatus gives practically a continuous test on the plant and facilitates the testing of any single element.

The tannery buildings north of the river are supplied with power by means of three conductor cables, each conductor being 500,000 centimeters in section, which are carried under the river. Softened water is furnished to these buildings from the purifying plant through a twelve-inch pipe carried beneath the bed of the river.



AUTOMATIC CARBON-DIOXIDE RECORDER.

The complete and careful attention to all details as mentioned above and the fact that the plant is so carefully arranged that only three men, an engineer, a fireman and an ash handler, are required to operate the entire plant, make it one of the model industrial plants of the country. It was designed and constructed under the superintendence of C. P. Bossert, the chief engineer of the company.

An electrically driven duplex pump has recently been installed in the Bullfrog-Mohawk mine, near Rhyolite, Nev., to drain the workings.

Southern Railway to Use More Gas-Electric Cars.

The Southern Railway Company announces that as a result of the success of experiments with gas-electric cars, two of which have been ordered, it is probable that their use on the lines of the company will be further extended.

A careful study has been made of the conditions on parts of the line where suburban business is heaviest, and in commercial districts where passenger travel is thickest, with a demand for more frequent service. While no definite conclusion has been reached, it may be that the company will put gas-electric cars into service in some of these localities, either substituting them for the present local steam trains, or as supplementary to the present local steam service so as to give more frequent service. One of the localities where this service may first be put in operation is in the active manufacturing territory of South Carolina, which the conditions would seem to suggest that such service would most conveniently accommodate the milling towns of Seneca, Anderson, Belton, Williamston, Pelzer, Piedmont, Greenville and Spartanburg.

In the cars ordered for the Southern Railway lines the generating engine and electrical machinery are in the forward end of the car. Next thereto is the compartment for colored passengers with toilet rooms. These two compartments occupy about one-half of the total length of the car, the remainder of which is a compartment for white passengers, with seats and toilet room arranged as in a day coach. The car is handsomely decorated and is lighted throughout by electricity. It can be run at any speed up to sixty miles an hour. The motive power is sufficient to enable it to haul a trailer or extra coach.

Brennan Monorail System for Alaska.

It appears that the first practical application of Louis Brennan's gyroscopic monorail car is to be made in Alaska, where a system of monorail railroads will be built connecting several camps. Exclusive rights to use this car in Alaska have been granted to an American syndicate, represented by J. E. Ballaine, of Seattle, Wash., and a firm of New York bankers. The syndicate has agreed to build 100 miles of railway within one year following the completion of two cars, an order for the construction of which has been given to Louis Brennan, in London. Mr. Ballaine is quoted in reports as follows: "I estimate the cost of the 100 miles of line we are going to build from the Matamiska coal fields towards Fairbanks will not exceed $3,000 a mile, compared with at least $20,000 for even the lightest double-rail track. The ability of the gyroscope car to take curves will obviate most of the engineering difficulties. If the initial road proves a success, which I fully anticipate it will, branches will be laid to the various gold fields, greatly increasing the Alaskan gold output."

Boiler Efficiencies and Feed Water.

In a paper by L. M. Jockel, recently presented before the Junior Institution of Engineers, in England, the author stated that the efficiency of a boiler depended largely on the quality of the feed water, and especially was this true in the case of water-tube boilers. A deposit of scale only one-sixteenth of an inch in thickness, he said, would cause a waste of fuel of from ten to fifteen per cent, and the waste increased almost proportionately with the square of the thickness. Experiments proved that even a thin film of grease on the inside of boiler tubes caused a loss of efficiency of ten to twelve per cent. The absolute removal of oil from the feed water could be effected only by coagulating the globules by chemical or electrical treatment, as in the Davis-Perrett process, and then arresting the resultant coagulant by mechanical filtration.

Electric Motors at Panama.

The thirty-horsepower motors used at the Ancon (Canal Zone) quarry plant in operating the four small crushers failed to furnish sufficient energy to drive the machines at their maximum capacity. Four fifty-horsepower motors were therefore ordered and have recently been installed. The primary, or large crusher is operated by a 250-horsepower motor which furnishes ample power.

Municipal Waterpower Project.

Bedford City, (Va.) has recently arranged to sell $100,000 of municipal bonds to raise money for developing a municipal waterpower. At the begining of this year the town bought the dam at Snowden on the James River, and it is this side which will be utilized.

The town owns 4,500 acres of mountain land, and water rights for several miles along the river in addition to the dam. It paid for the property $32,500. Definite plans will be drawn by competent engineers, as soon as possible, and at least 1,000 horse-power will be transmitted to Bedford City at the first development. As the demand increases, more power can be developed, and an additional dam can be erected if necessary.

The waterpower thus developed will be converted into electrical power and distributed throughout the town for mechanical purposes. It will be a great inducement to new industries and ought to give Bedford City an industrial boom.

Ohio Public Utilities Bill Defeated.

The bill providing for a Public Service Commission in Ohio, similar to those in Massachusetts, New York and Wisconsin, was defeated in the Senate and the Legislature which recently adjourned.

The Choice of Photometers.

At a recent meeting of the Illuminating Engineering Society of Great Britain, there was a discussion on the measurement of light and illumination in which quite a number of speakers participated. A. P. Trotter said that photometry, both for illumination and for candlepower, depended very much upon the instrument one was accustomed to. There was no "best" photometer. Anyone having practical experience with any fairly good photometer could do almost as good work as anybody else. The more one knows about a particular instrument the better work one can do with it.

The Tyndall Lectures.

The Tyndall lectures at the Royal Institution in London, Eng., have already begun. On June 4 last, Prof. J. A. Fleming began a course of two lectures on "Electric Heating and Pyrometry."

The foreclosure sale of the twenty-eighth and twenty-ninth Street Crosstown Railroad Company, of Kentucky, has been postponed until June 29, at the request of the bondholders' reorganization committee.

NATIONAL DISTRICT HEATING ASSOCIATION.

SECOND ANNUAL CONVENTION AT TOLEDO, OHIO.

The second annual convention of the National District Heating Association was held at the Boody House, Toledo, Ohio, on June 1, 2 and 3. Considering that the association is less than one year old, the meeting was quite well attended by representatives of member companies and those of manufacturing and supply houses. An excellent program of papers was presented and these drew forth spirited discussion.

At 11 o'clock on Wednesday the first session of the convention was called to order by President A. C. Rogers, who without further formality proceeded to deliver his presidential address.

In this address Mr. Rogers traced the evolution of engineering from ancient times to the present century. Taking up the subject of natural resources he said these have been so abundant that we have been drawing on them without thought of results or consequences. It is at the present time that we are beginning to talk conservation. While the engineer has always worked with a knowledge or acquaintance with economy, yet today we realize that an absolute necessity exists to put in operation all that the name implies. It is for the future in the matter of the retrenchment of our waste and the conservation of all our natural wealth that the world looks to the engineer. The mines need their resources to be prolonged so that future generations may enjoy some of the good of them; we can say the same of almost all our avocations. In the problems of which this association is most particularly interested we must join hands with the mechanical and electrical fraternity. Conservation is the keynote and the ultimate result of that will be the elimination of the isolated power plant and the concentration of all generating sources, to the end that large units with all the advantages of economical apparatus and surroundings, of location, buildings, equipment and men, will give us the most for the least, the last reduction in productive costs and the largest output for the same. And with that will come the enlargement and growth of district heating.

Hon. Brand Whitlock, mayor of Toledo, delivered a very pleasant address of welcome.

D. J. Hard, of Cleveland, responding to the mayor's address, called attention to Toledo as the birthplace of the association. It was in the very same room, less than a year ago, that the organization was formed. Moreover, one of the earliest heating plants was installed in that city and today Toledo boasts of at least three stations, one of which is probably the largest hot-water heating system in the country. The business of supplying heat from central stations has become a large industry.

William A. Wolls, of Columbus, Ohio, in the absence of Secretary D. L. Gaskill, who had been called to the bedside of his dying father, read the secretary's report for the period ended May 27, 1910. The total receipts were $600.53, the total expenditures $436.04, and the balance on hand $164.49. The association issued a souvenir program for 1910.

When Mr. Gaskill had assumed the duties of secretary there were thirty-two active members. Since then there have been fifty-three applications for membership.

A MODERN HOT-WATER HEATING STATION.

At the Wednesday afternoon session, the first number on the program was a paper by W. A. Wolls, of Columbus, Ohio, entitled "Description of Modern Central Hot-Water Heating Station."

Mr. Wolls gives a very concise description of the heating system of the Columbus Railway and Light Company, with which he is connected. The station contains six 350-horsepower water-tube boilers, two of which are arranged for use as water-heating auxiliaries for the heating system. The generating equipment consists of three compound-engine-driven units aggregating 1,150 kilowatts and a turbo-generator of 1,000 kilowatts, which is run condensing, but can also exhaust into the heating system. The water circulating in the heating system is heated in a standard condenser equipped with vacuum pumps. The electrical equipment of the heating station is run in parallel with the main generating station so that the kilowatt output of the former can be varied in accordance with the demand for heat. A carefully drawn-up schedule is used for regulating the temperature of the heating water in accordance with the weather. A steel expansion tank 6 by 12 feet is used in connection with the heating system which is maintained at a pressure of four to eight pounds gauge. A set of instruments is used for recording the temperature of the air, and of the ingoing and outgoing heating water. An anemometer and register is also used for recording the wind velocity. The heating supply mains are laid in wood conduit about four feet below ground; around the pipes the conduit is filled with oil-treated shavings. Along the conduit is laid a galvanized-iron pipe for carrying compressed air to operate thermostats on each heating customer's premises. There are 4.1 miles of mains consisting of twelve-inch to two-inch steel pipe with screwed couplings and expansion joints. Valves and expansion joints are inclosed in manholes. Heating service is furnished to customers at the rate of fifteen cents per square foot of radiating surface per year. Heat is furnished whenever the outside temperature is below seventy degrees Fahrenheit.

In reply to a question Mr. Wolls said that up to the present time the company has charged off forty-five per cent of the station's cost of operation to the hot-water heating department and fifty-five per cent of it to the electrical output. The largest customer on the system was a state institution having sixty-six thousand feet of radiation. Mr. Wolls would rather see the business split up in smaller houses. One has better control of it. An adjustment of that large building requires a half-dozen men a week or two weeks to cover and the likelihood of its being tampered with is much greater. The valve is set on the return end of each radiator. No trouble is found after the valves are set. Customers do not interfere.

CENTRAL-STATION STEAM HEATING IN DETROIT.

The next paper presented was one on "Central-Station Heating in Detroit," by A. D. Spencer, superintendent of the meter department, Central Heating Company, Detroit.

There are two steam heating companies in Detroit—the Murphy Heating Company and the Central Heating Company. The former operates a Paul vacuum heating system in connection with an electric power plant, a cold storage plant, an ice plant, and a central-station brine circulating system. It has a generating equipment of four Curtis turbo-generators aggregating 4,000 kilowatts. There are 320 consumers with 380,000 square feet of radiation in the heating system. All steam is sold by meter, the rates ranging from fifty-eight to fifty-three cents per 1,000 pounds, depending on the amount of consumption. The Central Heating Company operates a couple of separate plants and systems; one is a live-steam power and heating system in the business district and the other an exhaust-steam heating system in the residence district. The latter plant is an electric generating plant owned by the Edison Illuminating Company, the exhaust being sold to the Central Heating Company; the plant had almost been abandoned but was overhauled on the organization of the heating company; this plant is now carrying about 300,000 square feet of radiation. The live-steam plant was designed for the ultimate installation of turbo-generators, which have not yet been put in; it carries about 400,000 square feet of radiation and power load equivalent to about 100,000 square feet of radiation in addition. These two systems are connected by a ten-inch high-pressure tie line. The mains of the live-steam system are comparatively small. Trap troubles have been experienced on the thirty-pound distributing mains. The 110-pound power service has proven unsatisfactory for lack of a steam meter, as well as on account of trap and other troubles; this 110-pound service is installed in tunnels at a depth of about thirty feet. The rest of the live-steam mains are laid in either wooden log or concrete conduits. The exhaust-steam plant contains three engines direct-connected to generators aggregating 1,500 kilowatts; there are also motor-generator sets of 1,000 kilowatts total rating, which serve to transform current to or from the rest of the Edison system. All condensed steam at each consumer's installation is metered. Readings and inspections are made every six days. A number of tables and curves are given in the paper that show analysis of costs and income of both plants of the Central Heating Company. The live-steam plant operated as an auxiliary of the electric company secures for the latter much attractive business in the central portion of the city which would otherwise be served by isolated plants or a competing electric and heating company. Mr. Spencer's conclusions are that a live-steam heating system can profitably compete with private heating in a high-

class residence district, if considerable business can be obtained in a compact territory. In a business district a live-steam heating system should not be undertaken except in connection with an electric supply business. The advantage of an exhaust steam heating business depends upon the ability to dispose of the electricity generated at a profitable figure. In general, unless the heating load is very small compared to the electrical business, it will be difficult to dispose of the current at a profitable figure; where there is competition with a larger plant the value will be low; where there is no larger plant it will be difficult to dispose of the current at any price.

The reading of this paper was followed by a long discussion of metering. Mr. Spencer said the chief difficulties found were that the meters stop. The style of meter used in Detroit runs on roller bearings. These are designed particularly with reference to the conditions under which they work, heat, expansion and so on. In spite of that they get clogged with dirt and grit.

Geo. W. Wright, of Baltimore, said he has the meters on his system read every day. There are 375 meters and a number of men can read the whole lot. The meter reader also inspects the trap and meter every day and sees to it before he leaves the building that it is operating all right. The records and conditions found are posted. At the close of each day's work, men are sent out to make any repairs that are to be made. If a meter has stopped it is repaired and is going the next day. By that means they do not stop over two days. On an average not over five per cent of the meters in service each year actually stop recording. They are all brought in every season and tested for accuracy, balanced up and put in good condition. The meter costs amount to only about three per cent of the entire distribution costs.

Mr. Higgins said the Murphy Heating Company had no steam traps whatever. It used hydrostatic seals and most of the time the customers clean out their own systems. There are on an average about four meters out of 350 that stop up each year.

At this point the discussion turned on the heat-unit basis of buying coal. Mr. Morrissey, of Detroit, explained in detail how the heat-unit system is worked out by the Central Heating Company and the advantages that result from it. An analysis is made every week of an average sample of every car of coal brought in. At the end of the month the average of the weekly analyses is taken as the analysis for the month and the amount paid the coal company is based on this analysis. Others who discussed this subject were Messrs. Wright, Schott and Rogers.

C. R. Bishop, of Lockport, N. Y., referring to the income of the Detroit plants, thought that one-half cent per kilowatt-hour current is high. He knew of plants that make it for far less. In his own plant current is bought in as large quantity as desired at a slightly less cost than one-fourth cent per kilowatt-hour.

Mr. Spencer replied that in some tables in his paper the costs are analyzed in the two systems and it is shown that the operating costs are less in the exhaust-steam plant, thirty-four cents against forty-two cents in the live-steam plant; that the much larger fixed charges in the exhaust-steam plant, however, bring the total costs up to as much there as they are in the live-steam system.

THURSDAY SESSIONS.

The second day's sessions were opened in the morning by a lecture on "Humidity, Its Necessity and Benefits," by Dr. W. W. Brand, health officer of Toledo. In this excellent lecture Doctor Brand spoke of the importance of the conservation of public health. Too little attention has been given to regulation of the humidity of rooms heated in winter. As a rule they are too dry and as a result the nasal, throat and respiratory organs of a person confined in heated rooms become irritated from lack of the requisite moisture and therefore very sensitive to colds and other infections. By the use of appropriate humidifiers that will maintain the relative humidity of the air at about fifty per cent, nasal, throat and lung troubles are greatly reduced and a less degree of heat is required to make a room comfortable.

CENTRAL-STATION HEATING.

A paper on "Central-Station Heating" was next presented by F. H. Stevens, of Chicago, who by way of introduction said that his paper had been written in response to a query why there are not more people in the electric central-station business who are also in the district-heating business.

Mr. Stevens pointed out in his paper that heating from a central station has now been developed to such a high state of perfection through the knowledge of the proper methods of installing insulating, and conducting a system of this kind that no manager of an electric light, power or railway plant should ignore its possibilities for increasing the revenue. The advocates of central-station heating have had the opposition of many consulting engineers and engine builders, but this was because the engine would not operate at a high efficiency when its exhaust is utilized for heating; instead of producing a kilowatt-hour with eighteen or twenty pounds of steam it might require forty to fifty pounds in cold weather when the exhaust is used for heating. However, Mr. Stevens works out a problem showing the comparison in a 5,000-kilowatt plant operating with and without an auxiliary heating system to show the value of utilizing the exhaust. First he assumes the plant to run condensing under a twenty-six-inch vacuum, this taking twenty pounds of steam per kilowatt-hour, or a total of 100,000 pounds per hour, and yielding a total revenue of $250 per hour at five cents per kilowatt-hour. Then, when running as a combined power and heating plant, he assumes a steam consumption of forty-five pounds per kilowatt-hour, or a total of 225,000 pounds per hour. In this case the added revenue from the sale of the exhaust steam for heating at sixty cents per 1,000 pounds is $135, or a total revenue of $385 per hour. To produce the extra steam, with coal costing $2.50 per ton, firing thirty cents per ton, water five cents per 1,000 gallons, and with an evaporative efficiency of seven pounds of water per pound of coal, would entail an extra cost of $26.25 per ton, and still leave a net revenue gain of $108.75 in favor of the heating system.

Mr. Bishop was called upon by President Rogers, in reply to a question put by one of the members with reference to the statement commonly made that it is more expensive to operate a live-steam heating plant than it is an exhaust-steam plant and that there should be more waste using a high steam pressure for heating. Mr. Bishop said he would state some facts and allow the members to apply the theory themselves; that the relative cost of the two systems was a matter more probably of plant efficiency; that in the boiler room in the two systems there are different units in operation and that different boiler-room conditions exist.

Mr. De Wolf, referring to Mr. Steven's paper, said there is one point which he has not taken into consideration, which will come in in determining a plant's efficiency. He has given certain figures on an hour's operation. That comparison is representative of that particular hour's operation, but one has to operate the plant twenty-four hours.

Mr. Spencer pointed out two other considerations in the paper. The first one was that Mr. Stevens has assumed that he could sell all of the steam which is produced. In Detroit they sell not more than seventy per cent, excluding the steam used for heating the feed water, so that certainly would reduce his saving by thirty per cent. Again, these figures assume that one can always sell all of the exhaust steam and

would always have enough electric load to supply the exhaust steam necessary. In other words, that the heating load and electric load would always be the same.

Mr. Wright introduced a resolution calling for the appointment of a committee to revise the constitution so as to make it more in harmony with the rapidly growing requirements of this association. This was adopted and this committee is to report to the executive committee not later than April 1, 1911, so that the revisions be submitted for consideration at the next annual convention.

At this point R. E. Wooley, of the General Electric Company, gave an interesting description of a flow meter which is marketed by his company, explaining in detail its construction and its advantages over the older styles.

Immediately after the noon recess the following were appointed as the committee on constitutional revisions: D. L. Gaskill, Greenville, Ohio; George W. Wright, Baltimore, Md.; Grant Miller, Toledo, Ohio.

The committee on convention, time and place is composed of W. K. Martin, Crawfordsville, Ind.; A. D. Spencer, Detroit, Mich.; R. D. De Wolf, Rochester, N. Y.

INSULATION.

A paper entitled "A Study on Insulation," was read by W. E. Richards, of the Toledo Railway and Light Company.

District heating was first started about forty years ago and its early failures were caused chiefly through lack of knowledge of efficient means for insulating the heating mains. Along with tunnels, concrete and vitrified tile conduits, as well as wood logs, there are used five different pipe coverings, viz., magnesia, asbestos, wool felt, mineral wool, and air cells. Air confined in small cells is seemingly the most effective insulation for piping systems. The insulation of piping is now so improved that manufacturers stand ready to guarantee pipe coverings such that steam at fifty pounds pressure can be delivered one-half mile with a drop in temperature of only two degrees. When using exhaust steam for heating the most perfect heat insulation is necessary and expensive construction is justified. When using hot water with forced circulation, wood-box conduits can be used and the initial cost materially reduced because the high specific heat of water makes the heat loss relatively low; at the same time the decreased life of pipes carrying water as against steam makes it desirable to reduce the installation cost as much as possible. Where the insulation is subjected to knocks or jars and excessive moisture, wool felt is the best material to use. Magnesia and asbestos are best on high-pressure steam piping and also excellent on low-pressure mains. Concrete conduit with wool felt lining for a four-inch hot-water feed main and return, complete with expansion joints, anchors, etc., cost about $6 per lineal foot of conduit. Similar piping installed in a triple wood box filled with shavings costs about $2 per lineal foot. Which of the two constructions will be the more economical in the end is a debatable point. At the close of his paper, Mr. Richards pointed out the need of insisting on the covering of all piping in buildings that is not paid for as actual radiation.

UNDERGROUND INSULATION.

A paper entitled "A Study of Underground Insulation," was then presented by C. H. Staten, of Cleveland, Ohio.

The main losses to be encountered in a central-heating plant are from the pipes run underground rather than any other section of the system. In the case of from fifty to sixty per cent of such plants which at the present time are not representing a profitable investment the losses incurred by improperly protecting these underground lines are responsible for their condition. The increasing use of low pressure and exhaust steam in central-plant work has made essential the use of still better insulating mediums than any sectional form of covering at a lower initial cost of installation and with complete protection of such insulation from moisture. An efficiency should be obtainable of from ninety to ninety-five per cent. This then makes it necessary to regard both protective covering and insulating mediums as one unit, which is accomplished by the use of a tile conduit, made up in half sections with independent supports for the enclosed pipes and providing ample room for sufficient insulation to obtain the high degree of efficiency demanded. The tile must be of the finest quality obtainable. Just so must the insulating material used be of equally high standard. In such a construction the insulating medium used is composed of asbestos fiber and ground sponge, known as asbestos sponge conduit insulation. Such a protection provides no opportunity for interior circulation of air, but on the contrary possesses myriads of minute air spaces. In view of the elastic nature of such an insulation, the pipes are permitted to expand and contract quite freely without detrimental effect to either the conduit or the insulating medium.

The paper was briefly discussed by Messrs. Lewis and Gifford.

CENTRALIZING THE HEAT SUPPLY.

The next paper presented was one by Prof. J. D. Hoffman, of Purdue University, Lafayette, Ind., and entitled "A Study in Centralizing the Heat Supply." In the absence of the author Mr. Gifford read this paper.

Conditions have so changed, because of increased fuel cost, that the economy of any method of heating is now closely inquired into. Central-station heating has brought about a decided gain in convenience to the householder, but the economy has also been improved, as Professor Hoffman undertakes to show by his analytical study. Centralization of the heat supply brings about economy because the fuel is burned more economically and the labor costs reduced; when developed in connection with a power plant it also utilizes much of the heat that would be wasted in the exhaust and flue gases; in fact, this is the chief source of its economy. Perfection of the conduit and piping system has been brought to such a point that the radiation losses in the conduit may be kept below ten per cent. An analysis of several cases is made by Professor Hoffman to determine the amount of heat in exhaust steam compared with the amount in saturated steam at the temperature of the exhaust under average conditions. From this he concludes that exhaust steam having eighty per cent of the value of saturated steam at the same pressure is the most reliable rating to use in calculating the amount of radiation to be supplied by the engines. When considerable exhaust is supplied by direct-acting steam pumps the quality of the steam will be higher. A calculation of a typical plant, which supplies electric light and power and does city pumping, is then made with the idea that it will also supply the heat for 184,500 square feet of hot-water radiation. As not quite enough heat would be supplied under the assumed conditions by the exhaust from the engines and pumps, an auxiliary 300-horsepower boiler is installed to supply the deficiency. The cost for a total of 18,100 feet of conduct piping of various sizes is given as $51,926, of 264 service connections $6,600, of 57 expansion joints $2,000, of additional equipment in the power house to provide for central heating, $30,900; the total for the heating plant is thus $91,426. Against this 264 private plants are figured at $132,000. Adding in each case depreciation at six per cent for five years, repairs, interest, etc., at eight per cent for a similar term, also labor and fuel costs for a five-year term, gives a total of $410,520 for the 264 private heating plants, as against $252,465.60 for the central heating plant.

There was some discussion of Professor Hoffman's figures in which Messrs. Powell, Rogers, Bishop, Robbe and Gifford participated.

After the adoption of resolutions of condolence to Secretary D. L. Gaskill on the death of his father, there ensued a discussion on the topic "Advantages to be Derived From the Combination of Heating and Power Business for the Central Station." This was opened by R. D. De Wolf, of Rochester, who first read a paper on "Decentralized Plants," which he had presented at the National Electric Light Association convention at St. Louis. He then stated that the economies which central stations would have over the economies which an isolated plant can achieve will be sufficient to make it worth while for them to go into the heating business and the further economies that they can get from tying together a number of these plants will make it still more worth while.

Mr. Bishop said he had just completed eleven weeks' investigation of the condition of operation in one of the larger cities. He had taken into consideration the operation of twenty decentralized plants in connection with one compound condensing central station. On the investigation of twenty-eight isolated lighting, power and heat plants, twenty were chosen as best suited for comparison. The average size of those plants was about 200 horsepower plant with economizers,

ash and coal conveying machinery and mechanical stokers. The firing and labor cost per ton was about $1.05. The central plant operated for less than forty cents per ton. The entire amount of heating load could be carried for a trifle less than $14,000. The interest and depreciation on the investment and such costs did not begin to overcome the difference in the labor item alone. The rumor was started about that town that if this idea of de-centralized operation were profitable to the central station, it was equally as profitable to the owner of the isolated plant, that with the same operation and same apparatus he could just as well take in a block system, build up the same efficiency practically as a larger plant would. One of the customers of this central station conceived the idea that with a block system he could work this out in his own way to advantage. So he had gotten various manufacturing companies to making prices on the apparatus needed. Mr. Bishop was asked to see if he could get a renewal of a ten-year contract for light, heat and power from this customer and prevail upon him not to build this isolated block plant. He showed him that the amount of steam he would get in a block from the operation of lights and elevators there would hardly heat the office in his own store. He convinced him so that he signed the contract.

Mr. Spencer said that when Mr. De Wolf gets his system of de-centralized plants, say twenty of them, connected together, both in a steam way and in an electrical way, and also connected electrically to the electrical system, he has a large central-heating system different from those that we are accustomed to, simply in the fact that it is fed from a number of plants in place of one. We all believe that the larger the plant and the smaller the number of the plants, the greater the economies. He did not see why it would not be more economical to have one plant supply all these buildings rather than twenty.

Mr. De Wolf stated that from his experience he had come to the conclusion that one could not operate a decentralized-plant system with plants of less than 350 horsepower. It is inadvisable for an isolated plant owner to operate a block scheme. In the first place he cannot get the expert experience in the plants and the expert design which the central station can and he has not the advantage of operating that plant in parallel with other plants. His cost for supplies, repairs, maintenance and so on will be higher than it will be for the central-station plant which has its own department and which gets its supplies in large quantities and consequently at a lower figure than this isolated plant. The central station offers a reliability of service which the isolated plant cannot. The isolated plant will have an unbalanced electric and steam load. The central station can balance that up.

FRIDAY SESSIONS.

The third day's session was opened by the report of the nominating commitee, which submitted two lists of nominees the first of which was elected as follows:

President, George W. Wright, Baltimore, Md.

First vice-president, A. D. Spencer, Detroit, Mich.

Second vice-president, W. J. Grambs, Seattle, Wash.

Third vice-president, Warren Partridge, Springfield, Ill.

Secretary-treasurer, D. L. Gaskill, Greenville, Ohio.

Members of executive committee: A. C. Rogers, Toledo, Ohio, and E. J. Keifer, Easton, Pa.

For the guidance of the executive committee, a ballot was taken as to whether the next convention should be held in the East or in the West. A large majority of the members present voted in favor of the East.

EXCLUSIVE HEATING PLANT.

A paper by Byron T. Gifford on "A Central Station Operated Entirely as a Central-Heating Station Exclusive of Electric Light or Other Industries" was then read.

Mr. Gifford's paper analyzed the operating conditions as well as gave a brief outline of the important features of a central-station heating plant operated exclusively for heating. Central-station heating work has been carried on almost entirely in connection with electric light plants. Beyond a doubt a heating plant can be made not only a physical, but also a financial success, if properly designed, installed and operated. This is equally as true of a straight fuel-burning central station heating plant, as it is of a by-product plant, but of course the by-product plant has the larger financial return. In the operation of an exclusive heating station the coal item is the greatest expense, consequently a plant to be successful must burn as little coal as possible and yet give perfect service to the consumer. To do this requires giving attention to three branches of the work. First, the power station where the heat is generated must be designed and operated so as to utilize every heat unit that it is possible to take from the coal; second, the pipe line must be so designed and built as to be a very good conveyor of heat; third, the equipment of the buildings which are to be heated from the central plant must be such to heat perfectly with a minimum amount of heat, thereby reducing the heating bill to the consumer, as well as increasing the capacity of the pipe line and consequently the heating system. Central-station heating plants are today as sure and as safe an investment as any other public utility. Mr. Gifford said that he did not want to give out the impression that a straight fuel-burning central-station heating plant will be a financial success under any and all conditions, but he did claim that such a plant will under ordinary conditions be not only a physical success, but also a financial success.

The paper was briefly discussed by Messrs. Lewis, Powell, Bishop, Spencer and Gifford.

The following committee appointments were then announced:

Committee on publicity: George R. Bishop, Byron T. Gifford, Joseph Graham, W. W. Macon, A. S. Armagnac, and Messrs. De Joannis, Weaver and Low.

Committee on meters: Messrs. Lewis, Hayward, Powell, De Wolf and Miller.

Committee on radiation: Messrs. Martin, Bly, Rogers, Higgins and Kiefer.

At the last session of the convention, that on Friday afternoon, President-elect Wright was called on to assume the chair and without further formality called for the reading of the next paper entitled "The Factors That Enter Into the Cost of Generating and Distributing Steam for Heating," by Charles R. Bishop, of Lockport, N. Y.

FACTORS THAT AFFECT THE COST OF GENERATING AND DISTRIBUTING STEAM FOR HEATING.

At the beginning of Mr. Bishop's paper is a plea for the purchase of coal on the heat-unit basis. Special treatment of the boiler-feed water is necessary when the latter contains over thirty grains of solids per gallon. Mechanical stokers, coal- and ash-handling apparatus and coal storage facilities are desirable when the plant gets above a certain size, as also are feed-water heaters or economizers. In a combined electric and heating plant the engines develop mechanical energy without greatly decreasing the heat energy of the steam, therefore, it is not necessary to install engines of the highest efficiency. Where a station contains several engines it is desirable to install an additional exhaust main so that any engine may be run condensing or exhausting into the atmosphere or into the heating system. The station should be fully equipped with measuring and recording instruments. In order to get a reliable conception of the operating and station costs a complete set of records should be kept and a number of typical forms were included in Mr. Bishop's paper. Frequent inspections of the distributing mains should be made and leakages and other troubles immediately attended to. Normal transmission losses are practically constant in properly installed systems and should not exceed 0.045 pound per square foot of mains and fillings. Unaccounted for steam is due to leaky air vents, leaky radiators and piping on consumers' premises, drips and returns not brought to the meters, inaccura-

cies of the meters, etc. Every outlet from the distributing system should be metered. The development of the meter has put the heating business on a sound basis equal to that of the supply of water, gas or electricity. The rates adopted must take into consideration the total operating and fixed costs and also local conditions, such as the cost of fuel to each individual consumer. Many companies compile records of not only station costs, output, etc., but also records of the steam consumption for different classes of buildings heated. Curve sheets should be kept of steam output, outside temperature, wind velocity and relative humidity. The daily load curve usually shows two peaks, which are less prominent however, when steam is sold on the flat-rate basis. The companies that make the greatest success in central-station heating are those that keep complete records and sell their output on the meter basis.

This paper was discussed by Messrs. Rogers, Higgins, Lewis, Spencer, De Wolf and Bishop, the latter adding many experiences and data gathered in his extensive association with the affairs of district-heating plants.

RELATIVE EFFICIENCY AND CORRODIBILITY OF DIFFERENT TYPES OF RADIATORS.

The next paper entitled "The Relative Efficiency and Resistance to Corrosion of Different Types of Radiators," by Herbert Orr, of Cleveland, Ohio, was read by Mr. Rogers in the absence of the author.

This paper contains a series of arguments tending to refute the aspersions that have been cast against the use of pressed-steel radiators. Mr. Orr points out that the good service given by the steel nipples used to connect the sections of cast-iron radiators and also the reliability of steel-pipe connections prove that steel radiators are durable, especially so since the pressed steel used is thoroughly galvanized so to make its thickness increase from No. 20 to No. 16 gauge. In many tests steel has been shown to withstand the corrosive action of impurities in water better than wrought iron, yet wrought-iron pipe is used with practically complete satisfaction. The efficiency of the steel radiator is fully equal to, or better than, that of the cast-iron radiator, contends Mr. Orr.

Mr. Donnelly, in discussing the paper, did not agree with the conclusions drawn by the author.

COAL PRODUCTION AND CONSUMPTION.

The last paper presented before the convention was on the subject "Coal Production and Consumption," by Prof. R. H. Fernald, of the United States Geological Survey.

Professor Fernald delivered a very instructive address, in which he stated that the reports of the United States Geological Survey show that if the rate of increase in the fuel consumption that has held for the past fifty years is maintained, the supply of easily available coal will be exhausted before the middle of the next century. This condition of affairs points to the necessity of conserving our fuel resources and also the necessity of utilizing grades and varieties of fuel which have not until recently been considered as commercially possible. He desired to point out the possibilities to be found in low-grade or high-ash fuels which are at present regarded as practically worthless, extensive deposits of lignite found in various sections of the country, also swamps and bogs covering vast areas containing peat. Approximately fifty per cent of the coal in the mines is left either in or at the mines and is accessible for future generations. Central stations for power and light are springing up all over the country. Electric lights are now in general use in towns numbering their population by hundreds only. Electric transportation for street railway service is practically universal and electric power for shop drive is in great demand. The substitution of the electric locomotive for the steam locomotive for terminal service and even for line duty by several leading railway systems is no longer a mere expectation but is an every-day working reality. These changes and developments in every section are, to a large extent, tending to do away with the individual small steam equipment, whether stationary or locomotive, and are bringing to the front the central power station ranging in size from lighting and pumping plants of less than 100 horsepower in smaller towns to those of 100,000 horsepower or more required to most metropolitan demands. In the development of central power plants and the reduction of the cost of power the producer-gas power plant is an important factor. In this connection the question of locating such plants directly at the mines is well worth careful and unbiased attention by the engineering profession. The advantages to be derived from such a location have already attracted the commercial interests of Europe. As examples worthy of thoughtful consideration the general conditions of operation of three typical European installations were described.

At the conclusion of Professor Fernald's address the convention adjourned.

Electrolysis of Chlorides.

At the ninety-eighth regular meeting of the Northeastern Section of the American Chemical Society, held at the Twentieth Century Club, Boston, on April 29, Prof. Henry Carmichael presented a paper entitled "Electrolysis of Chlorides Theoretically Considered," in which he described the advantages of a partition of asbestos cloth impregnated with portland cement, as a means of separating the electrode products in the analysis of brine. Jasper Whiting, in a paper upon "The Electrolysis of Brine," described in detail his electrolytic cell which makes use of the formation of sodium amalgam but is not open to many disadvantages possessed by the Castner process.

A recent dispatch to *The Mining World*, Chicago, Ill., states that R. M. Jones, of Denver, Colo., and several assistants are making a trip through the state of Sinaloa, Mexico, measuring the flow of the Sinaloa rivers with a view to future hydroelectric installations. They are doing the work for the men behind the Mayo River Land and Power Company, of Denver, which plans to install a hydroelectric plant.

Illinois Consolidation.

A consolidation scheme which involves the connecting up of twenty-six Illinois Valley cities and towns for the distribution of gas and electricity from central points has been advanced in Streator, Ill., by the granting of fifty-year franchises to Charles A. Munroe of the newly organized Illinois Valley Gas and Electric Company, a subsidiary of the Commonwealth Edison Company of Chicago, and the Economy Light and Power Company of Joliet, Samuel Insull being president of all three. The new corporation has been capitalized for $6,250,000 and a bond issue of $10,000,000 has been authorized.

Convention of the Northwest Electric Light and Power Association.

A combined convention and outing on shipboard will take the place of the usual form of convention of the Northwest Electric Light and Power Association this year. The convention will be held aboard the steamer *Queen*, leaving Seattle, Wash., on the evening of August 26, and returning the morning of August 29. The boat has been chartered for the trip and will visit the various Puget Sound cities, with stopovers at each place. The cost, including berth and meals, for each person, will be $10.

Papers will be presented on "Long-Distance Transmission," "Depreciation," "The Rate Question," "Employers' Liability," "Methods of Getting Business," and "Conservation." An orchestra will be provided and space has been assigned to exhibitors.

Electric Enterprise in Japan.

News comes from an English source to the effect that the Japanese Government will shortly proceed to make inquiries as to the hydroelectric possibilities available in Japan. An office will be established for this purpose under the control of the Department of Communication, and seven branch offices will be used in addition.

Electrically-Driven Dock Machinery.

The Cincinnati, Hamilton & Dayton Railway Company is planning to use electricity on its docks at Toledo, Ohio. Plans now under consideration contemplate the substitution of electricity for steam in the operation of the dock machinery.

DEFINITIONS OF ELECTRICAL TERMS.

REPORT OF THE COMMITTEE ON TERMINOLOGY OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

We give below the definitions proposed by the Committee on Terminology of the National Electric Light Association. These definitions are offered for criticism before final action is taken on them, and any suggestions or amendments to this list should be sent to W. H. Gardiner, 60 Wall St., New York city.

Ampere-Hour Meter—An instrument giving the total time integral of the amperes.

Auto Balancer—An auto transformer for equalizing the load or voltage when a three, or more, wire circuit is derived from a two-wire circuit.

Auto Transformer—A transformer in which a part of the primary winding is used as the secondary winding, or conversely.

Block Rate—Method of charging for electric service at different successive rates per kilowatt-hour consumed, each successive rate applying only to a corresponding successive block or quantity of the total current purchased during the period covered; as an example, during each month ten kilowatt-hours or less at fifteen cents per kilowatt-hour. The next ten kilowatt-hours over the first are charged for at twelve cents per kilowatt hour. All current in excess of the foregoing twenty kilowatt-hours is charged for at ten cents per kilowatt-hour.

Choke Coil—A reactance used in connection with lightning arresters and placed in series with the line to be protected.

Capacity Factor—Ratio of the station output in kilowatt-hours to the maximum capacity of the station in kilowatts.

Compensated Alternator—A separately excited alternator, which automatically compensates for the drop in voltage in its armature, or in its armature or the line, by sending around its field a rectified portion of the main current, or of the current derived from a series transformer in the main circuit.

Converter—A dynamo-electric machine having one armature and one field for converting alternating current to direct current, or direct current to alternating current. The term to be preceded by the words "alternating current-direct current" (A.C.-D.C.) or "direct current" (D.C.).

Constant—(1) Of an electrical instrument is that quantity which used as a factor with indications of instruments gives results in the desired unit.

(2). Of a watt-hour meter is 3600 × watt-hours passing through the circuit during one revolution of the meter disc.

Corrective Motor—A synchronous motor running either idle or under load, whose field charge may be varied so as to modify the power-factor of the circuit to which it is connected or through such modification to also influence the voltage of the circuit (this term is proposed instead of the term "rotating condenser").

Demand—Demand is a load specified, contracted for or used, expressed in terms of power as K.W. or P.

Demand Factor—Unless otherwise specified, demand factor shall be the maximum connected kilowatts of capacity divided into the actual kilowatts of demand, and expressed in terms of per cent.

Demand Rate—The price, or part of the price, of power charged for the demand as distinguished from the price paid for the kilowatt-hour consumption.

Discriminating Rate—A rate which does not give the same price to two or more customers, when all other conditions are equal.

Differential Rate—A rate consisting of two opposed factors; one tending to give a righ rate and the other tending to give a low rate.

Dispersion Factor—The factor applied to light intensity after dispersion, which gives the intensity if the dispersion agents were removed.

Diversity Factor—Diversity factor shall be used to express the relation between the simultaneous demand of all individual customers and the sum of the maximum demand made by these customers; the sum of the maximum demand of the customers, no matter at what time they occurred divided into the simultaneous greatest maximum demand when expressed in per cent will give the diversity factor.

Effective Demand—The demand taken at the time of the system's greatest maximum.

Effective Load-Factor—The meaning suggested is the main load of a part of a system determined by the load at the time of the system's maximum. This value would be infinity if the service were off at the time of the system's maximum as in the case of non-peak service. The term "effective demand" is suggested as a substitute.

Equalizing Rings—Rings connected to equipotential points of multiple-wound armature to equalize the voltage between the brushes.

Feeder—An electric circuit, used to supply power to a station or service, as distinguished from circuits confined to a single station or used for other purposes than supplying power.

Flaming Arc Lamp—An arc lamp using carbon electrodes impregnated with some light-giving material.

Flat Rate—Method of charging for electric service only a fixed sum per month, or per annum, for a specified service, as supplying a certain number of outlets, or up to a certain maximum demand without reference to the quantity of electricity actually consumed.

Frequency Changer—A piece of apparatus for changing from one frequency to another, consisting of a motor driving either an ordinary alternating-current generator or a machine constructed like an induction motor. In the former case the term is to be preceded by the words "motor-generator," and in the latter case by the word "induction."

Fuse—Electric—A conductor designed to melt or fuse at a certain value of current and time and by so doing to rupture the circuit.

Gem Lamp—An incandescent lamp using a carbon filament, which has a positive temperature coefficient of resistance.

High Frequency—A frequency so high that Ohm's Law does not apply even approximately.

Hydro-Electric System—An electric system with generator driven by water-power.

Induction Generator—A machine similar to the induction motor, but driven as an alternating-current generator.

Induction Starter—A device used in starting induction motors, converters, etc. (when they are started by voltage control), consisting of an autotransformer in connection with a suitable switching device.

Inductor Alternator—An alternating-current generator in whose armature windings the main magnetic flux pulsates but never reverses.

Instantaneous Peak—The highest value reached by the quantity under consideration as measured by some device which indicates the actual value of the quantity at every moment.

Insulator—Electric—A body or substance which offers such resistance to the passage of electric current that it is used to prevent the passage of current.

Intensified Arc Lamp—A term used for an arc lamp, with one of the carbons of small diameter to give a large current density per unit of arc, on which the arc plays to thereby intensify the light.

Leakage Reactance—That portion of the reactance of any piece of induction apparatus which is due to stray field.

Load-Factor—The fraction expressed in per cent, obtained by dividing the average load over any given period of time by the highest average load for any one minute during the same period of time.

Load-Factor Rate—A rate based on load-factor.

Low Tension—A relative term used to designate a winding or conductor of less voltage than that with which it is related or compared.

Maximum Demand—The maximum demand may be stated in kilowatts, horsepower, sixteen-candlepower equivalents, or any other term specified, but preferably should be stated in terms which leave no opportunity for error, and wherever possible should be stated in kilowatts. Unless specified, it shall always mean absolutely the greatest actual maximum demand. If the greatest actual maximum demand is not intended, but it is intended to express the greatest maximum demand for a given day or a given minute, then it shall be so stated.

Maximum Instantaneous Demand—The highest load reached as measured by indicating or recording instruments at any moment.

Maximum Simultaneous Demand—A maximum simultaneous demand shall be used to express the greatest absolute aggregate sum of certain individual demands, such as

(a) Customers,
(b) Class of customers,
(c) Classes of current,

and all rules made to define maximum demand shall apply to simultaneous maximum demand.

Momentary Peak—The highest average load carried during any fifteen seconds of a specified period.

Moonlight Schedule—A schedule of burning hours for lamps which are not lighted when the moon shines.

Non-Peak Rate—See "Off-Peak Rate."

Off-Peak Rate—A rate conditioned on the non-use of service during specified hours of central-station peak-load.

Operating Time-Factor—The ratio of the number of hours of operation to the number of hours in the interval considered. This can best be fixed by an example: There are 8760 hours in the year. If a given shop operates ten hours a day, for 300 days in a year, it may be said to have an operating factor of 34.11 per cent.

Operating Time Load-Factor—The load-factor considered only during the time of operation. This can also best be defined by example, and would be used to express the load-factor for the running time of a shop. That is, if a shop operates ten hours a day and 300 days in a year, the divisor would be 3000 hours, or such other number of hours, as represented the time of running instead of the usual divisor of 8760 hours in the year.

Peak—The highest average load carried during one minute of any specified period.

Peak Load[1]—The highest average load carried during one hour of any specified period.

Power-Factor Indicator—A device to indicate the power-factor of an electric current.

Primary—That winding of an induction

[1]NOTE—In the case of momentary peak load-factor, peak-loads, the terms may be preceded by the qualifying terms "hourly," "daily," "monthly," "yearly," etc.

motor or of a transformer which directly receives power. The term is to be preceded, in the case of transformers, by the words "high voltage" or "low voltage," in the case of induction motors by "rotating" or "stationary."

Quantity Increment Rate — See "Block Rate."

Quarter-Phase—A term implying the supplying of power through two circuits. The vector angle of this voltage is ninety degrees. This term is recommended instead of the term "two-phase."

Reactance Coil—A coil for producing difference of phase or for eliminating current.

Recording Ammeter, Recording Voltmeter, Recording Wattmeter—Instruments which make upon a chart a continuous record of the value of quantities they measure.

Regenerative Arc Lamp—A flaming inclosed arc lamp in which the products of combustion are circulating and brought rapidly in contact with the arc. The objects accomplished thereby are:

1.—To conserve the heat;
2.—To condense and deposit the solid products of combustion where they will not obstruct the light, and
3.—To exclude the oxygen and utilize rapidly the chemicals in the circulating gases.

Reverse-Current Relay—A relay used on a direct-current circuit, which operates when the current flows in the direction opposite to the normal direction.

Reverse-Power Relay—A relay which operates when the power in the circuit flows in the direction opposite to the normal direction.

Rotor—The rotating member, whether primary or secondary, of any alternating-current machine.

Secondary—That portion of an induction motor or of a transformer which receives power by induction. The term is to be preceded by the same words as in the case of "primary."

Simultaneous Demand—The sum of the demands of a number of services occurring at the same time.

Simultaneous Demand Factor—The ratio of the simultaneous demand divided by the connected load.

Simultaneous Maximum Demand — See "Maximum Simultaneous Demand."

Static Converter—A term not recommended for a transformer.

Stator—The stationary member, whether primary or secondary, of any alternating-current machine.

Step Rate—Method of charging for electric service at definite successive rates per kilowatt-hour consumed. Each rate applying to the entire quantity purchased during the period covered. As, for example, during each month ten kilowatt-hours or less at fifteen cents per kilowatt-hour. If over ten kilowatt-hours and less than twenty kilowatt-hours are used all are charged for at twelve cents per kilowatt-hour. If twenty or more kilowatt-hours are registered during the month, all are charged for at ten cents per kilowatt-hour.

Strain Insulator—An insulator used for the double purpose of taking the mechanical strain at a bend or at the end of a conductor, and also insulating the same electrically.

Synchronism Indicator—A phase indicator. A device for indicating the phase relation or the condition of synchronism between two or more periodic quantities.

Synchroscope — A synchronizing device which, in addition to indicating synchronism, shows whether the machine is synchronized fast or slow.

Transformer—A stationary piece of apparatus for transforming, by electro-magnetic induction, power from one circuit to another, or for changing, through such transformation, the values of the electromotive force.

Turbo-Generator—A steam turbine coupled to an electrical generator.

Voltage Regulator—A device for regulating or varying the voltage of a circuit. When it consists of a transformer (whose primary is in shunt to a circuit and whose secondary is in series with the circuit), whose ratio may be varied, the term is to be preceded by the term "induction" or "contact," according as the voltage is varied by changing the amount of magnetic flux between the primary and the secondary, or by changing the number of turns in the secondary in series with the circuit.

Voltmeter Compensator—A device used in connection with a voltmeter to make it read low by the amount of the line drop, and thus cause it to indicate the voltage delivered at the end of the line or at any other predetermined point of the line.

Watt-Hour Meter—An instrument giving the total time integral of the watts.

Wattless Component Indicator—A device for measuring the product of voltage of a circuit, and the component of current at ninety degrees with the voltage. This product is the heating effect in excess of the heating that would be given by a circuit of the same voltage and power at 100 per cent power-factor. The device is a wattmeter with coils connected to measure volts times current at ninety degrees from the voltage phase.

Forming Storage-Battery Plates.

A rapid process of forming lead storage battery plates, which has been evolved by Dr. Franz Fischer of the University of Berlin, is particularly suited for preparing plates of large surfaces. It consists essentially in first transforming the lead surface to a depth of about one millimeter into lower lead oxides and then reducing these to lead sponge. The lead-sponge plates are transformed, in so far as they are intended for positive plates, into PbO_2 by charging them in a diluted H_2SO_4 solution. To produce the lead-oxide coating, a one-per cent H_3PO_4, or a one-per cent Na_2HPO_4 solution may be used as electrolyte; but on account of its better conductivity the author has generally employed a ten-per cent solution of Na_2PO_4, which may be prepared by dissolving one kilogram of (crystalized) Na_2HPO_4 in nine kilograms of distilled water. The temperature may be eighty degrees centigrade.

The plates to be formed are arranged between kathodes of equal side surface at distances of about ten millimeters. The current intensity is adjusted so that the tension of the bath, which at the beginning may be about 2.2 volts, cannot reach 2.6 volts. The current intensity gradually decreases during the formation in the same measure as the poorly conducting lead-oxide coating on the plates increases. The formation requires from twenty-four to thirty-six hours, after which time the plates are covered with a very firmly adhering layer of litharge. This coating contains some phosphoric acid. After twenty-four hours the layer is sufficiently thick for most purposes.

Negative and positive plates are formed as follows: The oxide layer may easily be reduced to lead sponge, but with difficulty changed to PbO_2. The plates are reduced at ordinary temperature with a current intensity of one ampere per square decimeter of side surface in so-called storage-battery acid of a specific gravity of 1.18 until hydrogen is freely developed. Then the plates are washed in water for about 12 hours in order to remove the H_3PO_4. If they are to be transformed into PbO_2 plates they are charged as anodes with one ampere per square decimeter of side surface continuously in acid of a specific gravity of 1.09 until a complete development of oxygen takes place. The reduction requires approximately the same length of time as the formation, so that the entire process takes from four to five days.—*Translated and abstracted from Zeitschrift für Elektrochemic (Halle), May 15.*

Large Steam Turbine for Paris Power Station.

The St. Denis power station of the Compagnie d'Electricité de Paris, Paris, France, will shortly have added to its present equipment a 14,200-horsepower steam turbine with a maximum capacity of 20,000 horsepower. This will be used to drive a three-phase generator operating at 10,250 volts, twenty-nine cycles, and at a speed of 750 revolutions a minute. The new turbine will be designed on a principle which will permit great economy in space, in fact the new unit will occupy the room reserved for a set of 8000-10,000 horsepower.

Michigan Iron Mines Sold.

The entire upper peninsula holdings of the Michigan Iron and Land Company, comprising nearly a half million acres of mineral and timber lands in Marquette, Baraga, Dickinson and Iron counties, have been taken over under long-time options by the Oliver Iron Mining Company, a mining subsidiary of the United States Steel Corporation. The purchasers bind themselves to expend a large sum annually in exploring for minerals and on all the ore discovered and mined they are to pay a stated royalty.

THE RELATIVE COSTS OF THE THREE SYSTEMS OF ELECTRIC RAILROADING.

DISCUSSED AT A JOINT MEETING OF ELECTRICAL MEN IN CHICAGO.

At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers held at the rooms of the latter society on the evening of June 7, a paper was presented by F. Darlington on the "Economic Considerations Governing the Selection of Electric Railroad Apparatus."

Mr. Darlington's paper covered much the same ground as his recent address before the Chicago Electric Club which was reported at some length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 30, pages 891 and 892. There is no general rule by which the cost of electrical equipment of railroads can be determined because this cost is affected by a great variety of conditions such as the length of the road, the train weights handled, density of traffic, train speed, etc. Three electrical systems have been applied to the propulsion of trains, the direct-current, the single-phase and the three-phase systems. As regards the power-plant equipment the costs for these three systems would not differ greatly. For the transmission and distributing lines and substations the single-phase equipment would cost only one-fourth to two-thirds that of direct-current equipment and a three-phase system would cost from thirty to eighty per cent more than a single-phase installation, the exact ratio depending on the length of line electrified, weight, frequency and speed of trains, etc. A comparison of the three types of electric motors shows a saving of from ten to twenty-five per cent in weight and twenty-five to fifty per cent in cost in favor of direct-current motors compared with those of the single-phase type. Taking into consideration the added weight of the transformers the single-phase locomotive is about fifteen per cent heavier than the direct-current locomotive. Notwithstanding the increased cost of single-phase locomotives as compared with direct-current machines, which increase may amount up to twelve per cent of the entire cost of electrification in a road having a heavy and frequent traffic, the higher cost of power transmission and distribution by direct currents usually makes the single-phase system the more economical one, especially so on long lines and on those having relatively light traffic. The constant-speed characteristic of the three-phase motor Mr. Darlington regards as a great handicap to its use for traction purposes, as also the requirement of a double trolley for three-phase operation. The reliability of all three types of motors is unquestioned. The difference in efficiency of some five to seven per cent in favor of direct-current and three-phase motors is much more than offset by the decreased losses in a single-phase transmission and distributing system. In the latter the losses may be less than five per cent, whereas in a direct-current system they are seldom as low as thirty-five per cent. The difference in cost of repairs should not be greater than ten per cent against single-phase locomotives. The operating costs of direct-current substations form a large item of expense for which there is no counterpart in either of the alternating-current systems.

At the conclusion of the reading of the paper Mr. Darlington exhibited a number of very interesting lantern slides of various electric locomotives, making an especial point of the method of motor suspension. In the earlier types of electric locomotives the motor was suspended directly from the axle, so that in some cases the locomotive had a worse effect on the track than a steam driven locomotive on which the weight is almost entirely suspended by springs. One point which is much in favor of electric locomotives is that even when the wheels are driven by cranks through the medium of a jack shaft the motor can be perfectly balanced. He brought out the fact that the high center of gravity, which is found in the Pennsylvania locomotives is of distinct advantage, as the locomotive on making a turn does not spread the track, but tends merely to tip towards the outer side of the curve.

In discussion of the paper, G. T. Seeley mentioned some of the advantages which the South Side Elevated Railroad, of Chicago, had found to be a feature of electric drive. About thirteen years ago this road changed over from a steam system to an electric system, and by tests made it was found that the power house burned considerably less coal than did the locomotives formerly in use. In addition to this saving there was a material reduction in wages and the cost per car mile was reduced at least one-third.

W. L. Abbott called attention to the fact that although electric roads were in a great number, in fact in the majority of instances paralleling the steam roads, the latter do not seem to be alarmed by this state of affairs. There is no doubt, however, that the parallel electric roads are taking a great percentage of the local traffic of the steam roads and this percentage is constantly increasing. It is, he stated, in all probability only a question of time until high-tension power houses located at coal mines or at hydroelectric power sites will handle a very large proportion of the traffic of this country.

W. B. Jackson mentioned the Valtellina road which is in operation in Italy and which he had occasion to visit at the time of its installation. This road uses three-phase motors for cascade operation. For several reasons the three-phase system was favored here and it is in nearly all respects an ideal three-phase line.

Exception was taken by A. P. Jenks, of the General Electric Company, to some of the statements regarding the desirability of either three-phase or single-phase operation over the high-tension direct-current system. His objection was based on the assertion that the direct-current system is cheaper than the single-phase system.

A. Bement mentioned the growing popularity of electric lines with the general public, and brought out the fact that it was on this basis rather than on any particular method of operation that the growth of the electric-railway business depended.

Standardization was brought up for consideration by some of the speakers, and the point was made that there are at present some seventeen standard single-phase voltages and about seven different frequencies. Until some definite voltage and frequency is arrived at it can hardly be hoped that electric traction will become in any way universal.

George H. Lukes noted the advance in the ideas of electrifying ordinary steam railroads, and brought out the fact that it is only within the past few years that this has really been seriously considered.

Clarence Renshaw, of the Westinghouse Electric and Manufacturing Company, spoke briefly of the advances which had been made in all phases of the electric problem with particular regard to transmission. This, he stated, was the thing that had held the advance of the industry back and limited it in a way to tunnel transportation and to a few special cases. At the present time almost any trunk line can be profitably electrified by a single-phase installation and a fifteen-cycle, single-phase, 11,000-volt system would meet all questions of standards. He pointed out the fact that the losses in a high-tension transmission line were less, by a remarkable amount, than those in low-tension lines; and that the cost of maintenance is not necessarily high is shown by the books of one of the large companies which gives a figure of less than three-fourths of the amount found in a number of direct-current roads.

In summing up the remarks and points taken up in the discussion, Mr. Darlington gave a resumé of the things necessary in standard three-phase lines and also spoke briefly regarding the trolley-wire material which should be used in various cases.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

COOKING AND HEATING BY ELECTRICITY.

BY PUTNAM A. BATES.

While the use of electricity for heating dates back to the early days of the electric motor and other familiar electrical devices, its history, to a large extent, has been a chronicle of commercial failures.

Within the last few years, however, there has been a very marked development and improvement in the manufacture of electrical heating apparatus of all kinds. This is perhaps particularly the case with appliances for cooking, although, quite recently, a number of forms of electric heaters intended to meet special needs have made their appearance on the market.

The result of this activity among the manufacturers of this class of apparatus is that today we have an assortment of electrically operated cooking and heating devices, available at reasonable prices, which are thoroughly reliable and suitable for the purposes for which they are designed. In fact, being free from many of the disadvantages of older types in which fuel is burned directly, their superiority for domestic use is marked.

One of the very important advantages of this method of cooking and heating, is its freedom from fire risk. This is a very important point, which anyone will recognize.

How often we hear of serious fires arising from overheated furnaces or kitchen ranges, defective or dirty chimney flues or from an explosion of gas which has accumulated due to someone opening the valve and forgetting to apply the match until too late! Compared with this the danger of fire arising from a properly installed system of electric wiring is negligible.

The cost of cooking by electricity depends, of course, upon the cost of the electric current available. Many, however, are satisfied to dismiss the question of cooking by electricity with the thought or statement that it would be impossible for electricity, produced by the roundabout means of the steam boiler, steam engine, dynamo and transmission wires, to compete upon a cost basis, with the direct use of coal for cooking purposes.

Those who argue upon this basis lose sight of the advance which has been made by gas, also a product of coal, in this field where it very frequently is able to show a decided saving as compared with the direct use of coal for the same purposes. While the reason for this is two-fold, a brief study of the conditions will make it clear.

The cost of producing a definite total amount of heat by burning illuminating gas is considerably greater than the cost of obtaining an equal total amount of heat directly from a coal fire. The possibility, however, of confining the heat of the gas flame and applying it only where needed, introduces opportunities for saving in the cost of the gas range or heater which do not at all exist with the direct use of the coal fire. It is, therefore, due to the development of the apparatus itself that we are frequently enabled to use the former with greater economy than would be possible with the latter. The same is true with the use of the electric current only to an even greater degree.

The ease with which the electric current may be switched on or off makes this source of heat even more convenient than gas, and the ability to confine and apply the heat where wanted is much greater with the former than with the latter. In fact, it has been found by those who have made a study of this question that with the ordinary gas range fifteen per cent of the heat produced is usefully applied, while with the various high-grade electrical cooking devices, now obtainable, seventy per cent or more of the heat produced is utilized.

It is, however, a fact that electricity cannot compete successfully upon the basis of cost alone, with gas or coal for cooking and heating purposes at the rates ordinarily prevailing throughout our city and country districts, and electric-lighting companies generally are only just beginning to realize the possibilities in this line and to make systematic efforts to obtain this class of business. In this respect, I have in mind especially the central stations of the East.

This condition, I am glad to say, is improving and in many localities it is now possible to obtain current for such use at the prevailing power rate which naturally reduces the cost.

But for those whose places are equipped with private electric-generating plants of suitable capacity, the use of electrical cooking apparatus, and, to some extent at least, electrical heating apparatus may even prove an economy. This is apparent from the fact that the demand for electric current for cooking would seldom be coincident with the maximum demand for lighting and the generating plant would, therefore, be able to take on this additional load, without the necessity of enlarging it, and the only additional expense would be that for fuel used in the engine.

But even at somewhat greater cost of operation, electric cooking, in common with other electrical devices, has many advantages. For example, if the electric light had no other argument to offer in favor of its use than its cost as compared with other forms of illuminants, its progress would have been slow. In spite of this, however, it has come and is rapidly crowding all other forms out of the field. The reason for this is to be found in its many inherent advantages which have in most cases outweighed the higher cost of operation which is often found to prevail when compared with other forms of artificial light. The same is true of electrical cooking.

The rapidity with which food may be cooked by the use of electricity, the uni-

formity of temperature obtained which makes cooking by the clock a possibility, the great comfort and convenience, the cleanliness and freedom from smoke and smell incident to this method of cooking, make it ideal for all places where these advantages are of importance. As might be expected, the results obtained with this method are beyond all comparison with those from any of the older methods.

Unfortunately this ideal method of cooking has not been taken hold of by the manufacturers with sufficient enterprise and business judgment, the result being that there are few noteworthy installations, and of these, the number that have been actually tested with a view toward obtaining exact and use-

ELECTRIC RANGE IN A NEW YORK CLUB HOUSE.

ful information as to actual performance, is astonishingly small. A most interesting installation of this kind, which has come under my direction, is that installed in one of the prominent club houses in New York city, about three years ago. It is shown in the accompanying illustration and represents a type well suited to the requirements of any club house, large residence or hotel, where it is desired to secure the best of service obtainable.

The field of the electric range or grill is as wide as that of the older forms, using either coal, charcoal or gas, and a glance at the following menu will serve as evidence of the service of which these devices are capable.

Small steak	9	minutes
Sirloin steak	13	minutes
Tenderloin	6 to 12	minutes
Lamb chops	6	minutes
Mutton chops	8	minutes
English mutton chops	15	minutes
Veal chops	10	minutes
Pork chops	10	minutes
Broiled chicken	15	minutes
Poussin	15	minutes
Squab	10	minutes
Guinea hen	15	minutes
Deerfoot Sausages	4	minutes
Country sausages	4	minutes
Veal kidneys	15	minutes
Lamb kidneys	15	minutes
Mushrooms	15	minutes
Grilled or planked shad	6 to 12	minutes
Grilled sea bass	4	minutes
Grilled Spanish mackerel	4	minutes
Grilled lobster	5	minutes

There are two important reasons for the superiority of the actual cooking accomplished by the electric method. One is inherent to all electrical heating and cooking devices, namely, the entire absense of all flame, gas, smoke or dirt; the other is a result of the design of this particular type of apparatus. Each broiler unit is equipped with heating coils on both vertical sides and the spider containing the steak, chop, chicken, toast or other article to be cooked is inserted in a vertical position between the two sources of intense heat.

The current, therefore, passing through the coils produces heat simultaneously on both sides. This has the double effect of halving the times necessary to do the cooking and, in the case of meats, the outer tissues are at once seared, thus tending to prevent the escape of the natural juices which otherwise often drip into the fire and are lost.

A chop or steak, for instance, cooked in an electric broiler will be juicy, but evenly done throughout, and absolutely free from all gas or odor. Compare this result with a similar cut cooked over a fire, overdone on the surface, underdone in the center, charred in spots by the fire or burning grease as it often is, with most of the juice of the meat lost and a decided taste and odor of the fire!

The time required for the preparation of articles of food in an electric grill is important as a determining factor in the cost of the cooking process. This is particularly true in the case of a club or other restaurant, because of its bearing upon the quality of the service rendered, and the fact that the cooking can be accomplished in half the time means that a smaller grill may be installed. A reference to the above menu in connection with which the time of cooking is given, will serve to illustrate these points.

It is evident from the figures, all of which have been determined from average everyday actual operation, that even where the current is purchased, the cost of cooking is but a small part of the price charged for the service or even of the market value of the unprepared food. At a rate for electric current of three cents or better which is entirely possible with a properly designed private generating plant the cost of the current required for cooking becomes almost negligible.

With the smaller broiler units suitable for preparing food in smaller quantities the current taken is but half that used in the larger size units and the cost, therefore, is correspondingly less. Contrary to what might be expected, the repairs on these electric cooking devices are surprisingly small.

In the line of heating, the field for the use of electricity is more limited, being confined to special applications. General heating by electricity, except under very special conditions, is and probably always will be too expensive for serious consideration. There are, however, many applications where the advantages of electrical heating are sufficient to outweigh its greater cost. To meet these conditions, a number of electric heating devices have been developed and placed upon the market. Perhaps the most useful of these for home use is the electric radiator, designed to replace the unsightly and unsavory portable oil stove.

Those who have made use of the portable oil stove realize its most apparent shortcomings of disagreeable odors, need of daily care, danger from spilled oil and from fire, but few fully appreciate another important defect, which is not so apparent, namely, its bad effect on the air of the room. It is a fact that these harmless looking stoves take as much oxygen from the air when burning with an ordinary flame as ten or a dozen people would use in the same time. This is an important consideration in connection with the heating of a sleeping room or small living room, and it is in the small rooms that portable heaters are most used and most effective.

Changes in the Electrical Rules of the City of New York.

Announcement has recently been made by the Bureau of Electrical Inspection, Department of Water Supply Gas and Electricity, of New York city, that beginning with May 16, several changes have been made in the wiring rules of the city.

From that date the interior wiring rules comprised in classes D, E and F, as printed on pages 66 to 128, inclusive, will be withdrawn. At the same time the interior wiring rules of the National Electrical Code, edition of 1909, comprised in class D, fittings, materials and details of construction, and class E, miscellaneous, will become effective with the following modifications, which are rendered necessary by local conditions:

Class D.

50-B-e. Omit the fine print note relating to the neutral of an Edison three-wire system.

54-a. Omit the fourth fine print note relating to six-inch spacing in front of fuses.

54-b. In the first paragraph, after "sheet metal" omit "wood or approved composition."

54-c-d and e. Omit these three rules relating to wood or composition cabinets.

Omit the note and paragraph "a" of Rule 55, and substitute therefor the following:—

"(For installation rules, see No. 27.)

Owing to the interchangeability of carbon and metallic filament lamp bases, sockets must be rated, for installation purposes, at not less than fifty-five watts each, (see No. 21-d) except for sign and outline lighting.

Sockets of all kinds, including wall receptacles, must be constructed in accordance with the following specifications:

a. Capacity. The standard key socket must be suitable for use on any voltage not exceeding 250 and with any device requiring not more than 250 watts.

The standard keyless socket must be suitable for use on any voltage not exceeding 250 and with any device requiring not more than 500 watts.

The rated capacity in amperes is two and one-half for the key socket and five for the keyless. For larger capacities or higher voltages, sockets of special and approved design must be employed."

55-q. Substitute for the present rule and the fine point note relating to inlet bushings, the following:

When the socket is not attached to a fixture, the inlet must be so constructed that it will have a perfectly smooth hole at least nine thirty-seconds of an inch in diameter, or the inlet must be protected by a strong insulating bushing at least nine thirty-seconds of an inch in diameter and the upper portion of this bushing must present a thoroughly smooth opening which will protect the cord from any cutting or wearing action.

60-c. Omit the fine print note relating to terminal clamps for rheostats.

Class E.

64-a. Omit the fine print note relating to separation of signaling and electric light and power circuits.

64-1-3. Omit, in the first paragraph, the following:

"If attachment is made to gas pipe, the connection in all cases must be made between the meter and the street mains. In every case the connection shall be made as near as possible to the earth,"

and substitute therefor:

If the piping system is metered, the ground connection must be made between the meter and the street mains unless an approved jumper is employed to carry the grounding current around the meter.

65-A-a. Insert after "constructed," in second line, the words "so far as practicable."

65-A-c. Omit the first sentence and substitute therefor the following:

The top reel must be incased in a steel box or magazine with an opening of approved construction at the bottom, so arranged as not to permit entrance of flame to the magazine.

65-A-d. Omit the first two sentences and substitute therefor the following:

The bottom reel must be incased in a steel box or magazine with an opening of approved construction at the top, so arranged as not to permit entrance of flame to the magazine.

Add a new paragraph to read as follows:

The front side of each magazine must consist of a door hinged to swing horizontally and provided with a substantial latch.

65-A-f. Omit the present rule and substitute therefor the following:

An automatic shutter, permanently attached to the gate frame, must be provided, and must be so constructed as to shield the film from the beam of light whenever the film is not running at operating speed.

65-A-h. Substitute for the parenthetical clause the following sentence:

Departure from this rule will be authorized only under special permission in writing, given in advance.

The following additional rule, which is to be known provisionally as 64-A is hereby promulgated:

a. Aerial conductors to be permanently and effectively grounded at all times when station is not in operation by a conductor not smaller than No. 4 B. & S. gauge copper wire, run in as direct line as possible to water pipe at a point on the street side of all connections to said water pipe within the premises, or to some other equally satisfactory earth connection.

b. Aerial conductors when grounded as above specified must be effectually cut off from all apparatus within the building.

c. Or the aerial to be permanently connected at all times to earth in the manner specified above, through a short-gap lightning arrester; said arrester to have a gap of not over .015 inches between brass or copper plates not less than two and one-half inches in length parallel to the gap and one and one-half inches the other way with a thickness of not less than one-eighth inch mounted upon non-combustible, non-absorptive insulating material of such dimensions as to give ample strength. Other approved arresters of equally low resistance and equally substantial construction may be used.

d. In cases where the aerial is grounded as specified in paragraph "a," the switch employed to join the aerial to the ground connection shall not be smaller than a standard 100 ampere jack-knife switch.

It will be noticed that class F (marine work) disappears entirely from the city's rule under this rearrangement. This is for the reason that that class of work comes under Federal rather than that of Municipal jurisdiction.

Increasing the Efficiency of Gas Producers.

A method by which it was claimed the efficiency of a gas producer could be materially increased, was instanced by F. L. Maclaren in a paper recently presented before the Scientific Society of the Glasgow (Scot.) Technical College. The experiment described was by G. Tait, who substituted carbon dioxide for water vapor in cooling the furnace of a suction producer. Mr. Tait's engine developed a maximum horsepower of 106 when supplied with gas generated by passing air and steam into the gas producer in the ordinary way. When the supply of steam was stopped, the horsepower rose to 114, but the producer became overheated. To stop this overheating, Mr. Tait passed some of the engine exhaust under the fuel bed of the gas producer, and at the same time increased the compression to 200 pounds per square inch. This had the effect of increasing the horsepower of the engine to a maximum of 126; there was no pre-ignition or back-firing, and a continuous horsepower of 110 was obtainable with ease.

Electric Progress in Lapland.

The Swedish Parliament has sanctioned a vote of 21,500,000 kroner for the electric power establishment by the Porjus Waterfalls in the Lule River in Lapland, says the *Engineer and Iron Trades Advertiser*, in order that the railway traffic between Kiruna and Riksgraensen may be worked by electricity. Coal, owing to the heavy cost of transport, is very dear. Electric power will also be used for reducing iron ore into pig iron.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE ILLUMINATING ENGINEERING SOCIETY.

JUNE MEETING OF THE NEW YORK SECTION.

The last monthly meeting for the present season of the New York Section of the Illuminating Engineering Society was held as usual at the Engineering Societies Building, on the evening of June 9, the topics chosen for discussion being of the order usually selected for a cold winter's night instead of a rare day in June, and the attendance was correspondingly small.

Chairman E. L. Elliott announced as the first order of business the election of section officers for the ensuing year, which resulted in the unanimous election of the ticket prepared by the nominating committee, as follows: Chairman, Dr. A. H. Elliott; secretary, A. J. Marshall; managers, L. R. Hopton and S. G. Rhodes.

INCANDESCENT LAMPS AS STANDARDS.

The first paper, on "Incandescent Lamps as Standards of Luminous Intensity," by Dr. Clayton H. Sharp and Preston S. Millar, was read by the former.

The former practice in photometry of referring directly to primary flame standards has been superseded by the use of incandescent electric lamps. When properly seasoned and used the latter are superior for reference standards. Lamps intended for this purpose must be rigidly inspected for imperfections, high vacuum, and mechanical construction, including symmetry and good contacts. Seasoning can be carried out by frequent measurement of candle-power until constancy is reached, but a better method is by checking resistance. Under constant voltage, candlepower first rises, remains nearly constant for a time, and then falls off. This is due to corresponding changes in resistance. Use as a standard must be confined to the constant period. The resistance is best measured, not by readings of voltage and current, but in a bridge in which proper voltage is applied to the lamp. The watt consumption in a lamp also changes with candlepower, but it is not so convenient to measure this. Useful life is extended, however, by burning at constant watts rather than constant volts. The history of the electrical standards used at the Electrical Testing Laboratories was given by the speaker, also an account of the comparison of standards with those of foreign laboratories. The unit of candlepower used in this country has been changed during the past year by international agreement and agreement between the gas and electric light industries. The standard now maintained by the Bureau of Standards is 1.6 per cent lower than formerly. Utmost care is used in standardizing seasoned lamps and the substitution method is employed. This is the most suitable also for future use on account of accuracy and least burning of the standard. Standards of mean spherical candlepower are standardized by a series of measurements at various angles of the rotating lamp. Standard lamps should be of same general type and approximately same voltage and candlepower as those to be photometered. For work of higher precision, the Electrical Testing Laboratories has developed a lamp consisting of two hairpin loops, one within the other, lying in the same plane. Tungsten standards are used in photometering metallic filament lamps, on account of color difficulties, and some special types have been developed, including some for low voltage. Standard ampere lamps have also been prepared. The Electrical Testing Laboratories issues standards of two grades, corresponding to photometric accuracies of 0.6 and of 1.5 per cent.

PHOTOMETRIC UNITS AND NOMENCLATURE.

The second paper, on "Photometric Units and Nomenclature", was then read by the author, Dr. Edward B. Rosa.

In the introduction to Doctor Rosa's paper he states that there has been considerable vagueness in the use of such expressions as intensity, quantity, brightness, illumination, flux, etc. He attempts, therefore, to bring out the physical meaning and relation of the various quantities referred to and he does it in an admirably clear manner. At first there is a general discussion of these terms and a derivation of formulas. Starting with a point source it is found that such a source of light of intensity I produces a luminous flux in every direction, the numerical value of which at any given distance r is proportional to I and inversely proportional to the square of the distance r. If E is the illumination at distance r then $E = \frac{I}{r^2}$. If the light source is at the center of a sphere the latter is filled with the luminous flux which flows out uniformly in all directions. The total flux F on the inner surface of the sphere is then equal to the area multiplied by the illumination, or flux per unit area. That is

$$F = 4\pi r^2 E = 4\pi I$$

from the first relation. I is measured in candles, F in lumens and r usually in centimeters. Thus from a point source of I candles there is a luminous flux of $4\pi I$ lumens. The flux density is the luminous flux per unit of area normal to the flux, or $\frac{F}{S}$, if S is the area. When the flux density is variable it is $\frac{dF}{dS}$. If the source is not a point, but a small sphere of radius a, then the flux density of radiation is given by

$$\frac{F}{S} = \frac{4\pi I}{4\pi a^2} = \frac{I}{a^2} = E'$$

The flux density that falls on any material surface is the illumination E, the flux density as it comes from any luminous or other radiating or diffusing surface is the radiation E'; that is the radiation relates to the source of the flux while the illumination relates to the surface where the flux is received. The total luminous flux is not, however, the total energy flowing or radiating from a luminous body, because luminous flux, or light as it is ordinarily called is the physical stimulus which applied to the retina of tne eye produces the sensation of light. It equals the radiant energy multiplied by the stimulus coefficient. The latter varies for every different wave frequency and is zero for all frequencies outside the visible spectrum. The total radiating power may usually be measured in watts and the luminous flux in lumens. The ratio between them is not constant, as it depends on the spectrum characteristics of each particular source. If a certain light source is not symmetrical, but sends out flux unequally in different directions, then the mean value of the intensity is called the mean spherical intensity and its value is $I_s = \frac{F}{4\pi}$. Similarly the intensity in any particular direction is the ratio of the flux through a small solid angle in that direction to the angle. If it is a unit solid angle, or steradian, then $I = F$. If the value of the intensity I when the surface is unity be called c, then c is the specific light intensity or brightness of the source. The total quantity of light Q on a unit disk of area dS is equal to $c\,dS$; the total flux over the hemisphere, within which the radiation from such a disk is confined, is $F = \pi Q = \pi I_1$ where I_1 is the maximum intensity normal to the disk. The average intensity throughout the hemisphere is one-half of the maximum intensity and the mean spherical intensity is one-fourth of I_1. Therefore $F = \pi I_1 = 4\pi I_s$. In the case of extended source, such as circular disk of radius a, the illumination at a small plane area normal to the axis of the disk at distance r is

$$E = \frac{Q}{r^2 + a^2}$$

where Q, the total quantity of light on the disk measured in candles is the product of the area of the disk into its brightness or specific intensity c. If the disk were very small Q would be the same as the intensity I of the source, but for an extended source there is a distinction between the equivalent intensity I, and the surface integral of the specific intensity, which is Q. From the above equation it is evident that the illumination in this case is inversely proportional to the square of the distance to the edge of the disk. In the case of an infinite luminous plane the illumination at any point on a parallel plane is πc regardless of the distance between the planes. For an infinite luminous cylinder $E = \frac{Q}{2r}$ that is the illumination varies inversely as

the distance, whereas with a point source it varies inversely as the square of the distance. The total flux from any portion or the whole of such a cylinder having uniform specific intensity is equal to π times the quantity, as in the case of a circular disk. To obtain the flux of a unit length of the cylinder its equivalent intensity is multiplied by π^2. Therefore the spherical reduction factor of a short cylinder is π^2 divided by 4π or 0.785. To obtain the flux from the entire cylinder its flux per unit length is multiplied by the length, on the assumption that the cosine law holds good for the cylinder. It was next shown that for a sphere of any size and uniform brightness, the illumination produced is inversely proportional to the square of the distance from the center. It is generally true that the flux due to any surface S passing through another surface S_1 is the same as the flux due to S_1 passing through S, provided the specific intensity is the same in both cases. For a hollow sphere with uniform surface, every element illuminates all other elements equally; hence the indirect illumination of the sphere must be the same everywhere, no matter how unequal the direct illumination may be. If the coefficient of diffuse reflection be m, the indirect illumination is equal to $\frac{m}{1-m}$ of what the direct illumination would be with the source at the center. Thus if $m = 0.8$ and the radius be one meter, the direct illumination will be sixteen and the indirect sixty-four meter-candles, or the total illumination is five times what it would be if the walls were perfectly black. If the inner surface of a hollow sphere, or enclosure of any shape, have a uniform brightness, the luminous flux will be the same at every point inside, and a small area will be equally illuminated however it be placed or oriented.

The author then advocates the recognition of seven photometrical magnitudes, with standardization of symbols and units for the same as follows: The magnitudes are intensity of light, luminous flux, illumination, radiation, brightness, quantity and lighting; the symbols are respectively I, F, E, E', e, Q and L; and the units are respectively, candle, lumen, lumens per square centimeter, lux, candles per square centimeter, candle and lumen-hour. The lux is equivalent to a meter-candle. Luminous flux is the physical stimulus which excites vision. The luminous efficiency of a source is, for any wave length, the lumens per watt of radiation of that wave length. Illumination is the specific flux or flux per unit of area. When speaking of flux emanating from an area, the specific flux is called specific radiation, or simply, radiation. Brightness is specific intensity. Quantity is the surface integral of intensity. Lighting is the total luminous flux and depends upon time as well as intensity and surface. Definition equations are given for each unit and the paper ends with a collection of formulas.

The discussion was opened by V. R. Lansingh, who called attention to the discrepancy between the physical efficiency of a lighting installation and the visual efficiency owing to the varied conditions under which objects were viewed. This factor Doctor Sharp termed the physiological efficiency of the installation and, as a condition which illustrates the effect of direct light on the eye, he cited the ease with which one could distinguish objects under bright moonlight when viewed from a dark room as compared with the same room with the light burning.

ORNAMENTAL STREET LIGHTING IN CHICAGO.

VARIOUS BUSINESS ASSOCIATIONS PROMOTE SPECIAL LIGHTING SCHEMES.

Progressive merchants have long realized that the man who has the best lighted front makes the best impression. Hundreds of illuminated sign devices have sprung into existence and more recently ornamental street lighting systems have been installed with excellent results.

In various sections of Chicago, the special electric lighting of business streets has been taken up with marked success not only to the merchants on these streets, but to the lighting company supplying the current and to the community as a whole.

ORNAMENTAL STREET-LIGHTING INSTALLATION ON MILWAUKEE AVENUE, CHICAGO.

Among the first to realize the advertising value of such installations, were the merchants on Milwaukee Avenue, the great highway leading to the populous Northwest Side, who some two years ago organized a West Side Commercial League with the object of encouraging the residents to patronize the local business houses.

With the help of the Commonwealth Edison Company, Chicago, enough mer-

chants were interested in a more effective street-lighting system to insure its success. The installation was made and the beneficial results attributed not only resulted in an extension of this initial installation, but also in merchants in other parts of the city taking steps to install systems in their immediate neighborhoods. The installation of ornamental street lighting systems on North Clark Street, West Madison Street, East 22d Street, Ogden Avenue and West 12th Street soon followed.

The most recent of these special installations is on West 12th Street, extending from Ogden Avenue several blocks west. Twelfth Street in this location is one of the principal business thoroughfares of the southwest side and the merchants have had the question of an ornamental street-lighting system under consideration for some time, realizing the advertising value of the same.

The installation, at present, consists of sixty-five ornamental, cast-iron standards, equipped with four sixty-watt tungsten lamps, enclosed in globes of Alba glass. The lamps are installed ten feet above the sidewalk level, so as to be above the line of vision. They burn from dusk to ten o'clock six nights a week, and from dusk to midnight on Saturday.

Energy is supplied by the Commonwealth Edison Company. Underground construction is used entirely, all wiring being in conduits and connecting with the lamps through the posts. A switch for controlling the lamps on each post is installed at the base of each, although several posts are arranged for group control.

The rate charged is $1.50 per post per week, based on a two-year contract. Contracts are made with the individual merchant and the posts are installed wherever wanted.

ORNAMENTAL STREET-LIGHTING INSTALLATION ON WEST 12TH STREET, CHICAGO.

Street-Lighting Expenses in Los Angeles.

The *Municipal Journal and Engineer* in a recent issue gives an abstract of a report by R. H. Manahan, city electrician of Los Angeles, Cal., showing the expenses in connection with the extension of street lighting in that city and of the ornamental street-lighting system.

For the year ended July 1, 1909, the city's street lighting bill was $209,000. An increase of fifteen per cent is expected to be shown by the figures for the year ended July 1, 1910. For the year 1911, Mr. Manahan figures, 400 new arc lights must be installed to supply newly annexed territory, and the bill for arc lighting alone for that year at the present schedule will be $243,500. This is not counting any increases in the ornamental street-lighting systems. If ornamental lights now contemplated are put in they will cost $113,000 for the year 1911. Under the present system, with $40,000 expended for ornamental street lights, the city stands one-half of the burden and the property owners the other half. In view of the proposed extensions of boulevard lighting a proposition is now before the council to cut the city's share of the lighting to one-third. Ornamental lights are now on Main, Spring, Broadway, Hill, Fifth, Fourth and Carr streets. Applications are in for placing them on First, Third, Sixth, Seventh, Pico and Wilshire streets. The city at present pays for 3,200 arc lights. When the new territory is supplied it will pay for 3,600.

Power Plant for Hospital.

A new electric power and heating plant has been authorized by the directors of the New Haven Hospital, New Haven, Conn.

Flat Rate Residence Lighting; Discussion at St. Louis Convention.

At the convention of the National Electric Light Association at St. Louis, Mo., just closed, one of the most important papers offered for discussion was that by H. J. Gille, of Minneapolis, Minn., on residence lighting.

In the discussion was brought out the experience of the Hartford Electric Light Company, of Hartford, Conn., and the results obtained by that company with regard to residence lighting was a revelation to the central station men present.

There was no question but that residence lighting is profitable under ordinary circumstances but little more so when it is obtained with a high guaranteed income with low connected load. This latter feature is particularly necessary in residence lighting as it affects every physical part of the lighting company and permits economies of service which are most necessary.

Residence lighting is equally desirable in small and large communities, for no community is so small but that the business obtained as a factor in the business of the central stations.

The question of rate of charge for this service is one which has affected the result more than anything else and this fact is surprising when one considers that the manufacturing cost of current is definitely fixed. With every unit of price from one cent per kilowatt-hour up no proper determination is arrived at, for this is not the proper basis for charge as it does not give sufficient profit in the case of the short-hour burner and is usually too high for his neighbor who uses long hours.

Until the rate based on a fixed maximum demand on a per kilowatt year basis was tried at Hartford no satisfactory solution of the problem was obtained and in the meantime in spite of all the efforts of rate makers, developments in lamps and campaigns in current selling devices and improvement in measuring instruments less than ten per cent of the residences on central station lines in central station towns and cities are connected with the service of the lighting company.

The customers and the central stations' minds have not met on common ground for the reason that the central stations have not learned that most desirable factor in selling what the customer can afford to pay. The most effective method of selling current to residences is one which will secure their interest in large numbers and produce profit large in the aggregate from a multitude of small individual contracts.

There is no question but that the results obtained by those companies who have put the system of charging into effect advocated by Hartford, justifies its extended introduction as the income of $120 per kilowatt year secured thereby is larger than most companies obtain from the best business now on their circuits.

This rate plan is based on a charge of one cent per watt per month of actual demand used at any one time in connection tungsten lamps, the current to be used during ordinary lighting hours. The demand is fixed by the use of an excess indicator which protects the demand against increase without due notice. The hours of burning this demand are confined to ordinary lighting hours on account of the renewal cost of the tungsten lamp, but no condition of abuse would fail to produce a high average rate of income. This rate of income on a per kilowatt-hour basis is given at a minimum of six cents found by careful checking. This figure is merely given for comparison and has no vital bearing on the situation as the gross income amply covers all possible expenses and leaves a suitable margin for profit under any ordinary condition.

This rate applies particularly to that class who can afford to pay $1.50 per month average from a fixed demand of 150 watts with a minimum of $1 per month from a demand of 100 watts and appeals most forcibly to the head of the house whose income is from $12 to $20 per week.

There is no provision made in this system of charging for the customer who desires to extend his demand by the use of heating and cooking appliances except exactly proportionate to the current increase.

It is designed to meet the demand of the oil burner or gas user and to give them light at a cost which will approximate their present cost and they can be absolutely guaranteed that their cost will be definite and fixed, and the most important point of all is that this business is obtained at good profit by the limited flat rate method while it has not and cannot be obtained at any profit by the more usual kilowatt-hour by meter charge.

Wireless Telephotography.

The Sydney (Australia) correspondent of the London (Eng.) *Electrical Review*, states that exceptional interest has been aroused in electrical circles in Australia by the successful outcome of a long series of experiments undertaken by Reginald Wilkinson with the object of demonstrating the possibility of transmitting photographs by wireless telegraphy. A practical demonstration of this achievement is given in the *Sydney Daily Telegraph*, which prints a photograph of the late Sir Frederick Darley, and side by side prints the same picture as transmitted by wireless telegraphy. The likeness is extremely striking, even minute gradations of tone and facial individualities being reproduced with remarkable faithfulness.

The principle on which Mr. Wilkinson's invention is based is simply a matter of getting the picture on a specially prepared thin plate, whereby the lines and dots of the picture are exposed as bare metal, the remainder being covered with an insulating varnish. The slate thus prepared is placed on a cylinder similar to that of a phonograph, and revolves under a fine contact wheel until a fine needle point has completely covered the surface of the photograph, just as a phonograph needle traverses a phonograph record. The receiving apparatus is somewhat similar to the transmitter, but on this a piece of ordinary white paper is placed, which is covered with a piece of typewriting carbon. An electromagnetic needle is brought in contact with the covered surface, pressing on the paper an accurate reproduction of the photograph on the cylinder at the other station.

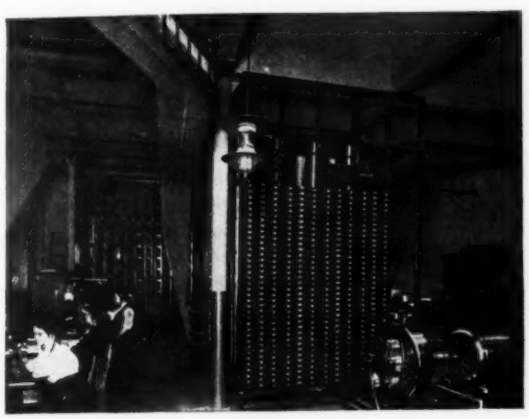
The experiment was conducted in the editorial offices of the *Telegraph*, and the demonstration was only from one end of the room to the other, but it was proved that the same efficiency can be secured between two points many miles apart. The receiver at the further end of the room was placed on a table, which was examined to make sure that there were no communicating wires.

The process is exceedingly simple, and presents unlimited possibilities both from a commercial and military point of view, in the latter respect furnishing a means of swift transmission of sketch plans, written orders, and photographs.

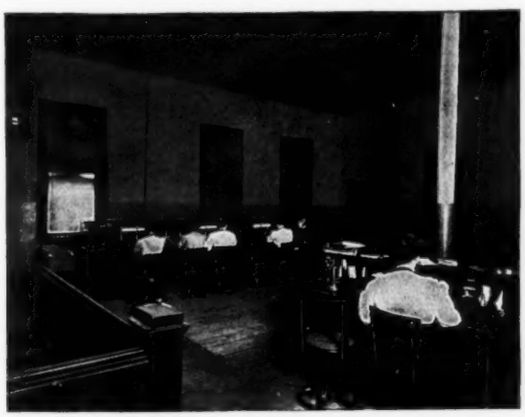
TELEGRAPHY—TELEPHONY, and WIRELESS.

New Telephone Exchange at Cedar Rapids, Ia.

A study recently was made of the telephone development of Cedar Rapids, Iowa. It showed that fifteen per cent of the population of that city are telephone subscribers. This is an astonishing figure when compared with the development in Chicago, 7.6; St. Paul, 5.7; and Kansas City, only 5 per cent.



TERMINAL ROOM, CEDAR RAPIDS EXCHANGE.



TOLL BOARD, CEDAR RAPIDS EXCHANGE.

The Cedar Rapids and Marion Telephone Company recently installed a completely new exchange to take care of this telephone business. Because of the large development in Cedar Rapids a switchboard was selected which could be made to grow to a large ultimate capacity with ease and one which was sure to give as good operating efficiency when the total capacity of the board is reached as at the present time.

The circuit arrangement and apparatus of this new telephone plant, which is now giving service, is in every way similar to the equipment in Chicago, New York and other of the largest and most efficient telephone centers.

The new Cedar Rapids switchboard has a capacity of 10,400 subscribers' lines, and at present is equipped for twenty-one operators' positions. The board is a Western Electric No. 1, containing all of the newest appliances.

The accompanying illustrations are excellent views of the operating room and the switchboard as it looks at present. The subscribers' switchboard is divided into positions for local operators, toll switching positions, where the connection between toll board and local subscribers is completed; rural and night toll positions, for handling spe-

SUBSCRIBERS' BOARD.

POWER PLANT.

cial traffic, and testing positions, in which are located the apparatus for testing circuits. The toll board consists of three No. 1 toll sections, each arranged for two operators' positions.

The mahogany exterior of this switchboard is simply a covering for the heavy steel frame, the details of which are so arranged that they support all of the apparatus and take all of the strain. In the rear of the board roller-curtains are provided, while in front removable panels allow ready access to the cords and wiring of all apparatus.

For this board are used three-wire cord-circuits of the repeating-coil type, the efficiency of which is extremely high.

The chief operator's desk has a capacity for two operators, who perform the usual duties of supervising the work of the regular operators. It has a capacity of twenty trunks from the subscriber's switchboard, over which any subscriber may converse with the chief operator. Ten circuits in connection with this desk are used exclusively for observing service given by operators and noting the language and deportment of subscribers as well as operators. Two-way trunks are provided with the chief-operator's desk and wired to the wire-chief's desk. Lines running to each of the operator's positions from this desk are so wired that the chief-operator's telephone may be bridged directly across the telephone of any operator without her knowledge.

The wire-chief's desk is arranged with sufficient testing circuits and plugging-up lines to permit trouble to be rapidly cleared. The trunk lines connect various parts of the telephone system with this desk, bringing the wire chief into immediate touch with any part of the system. The toll board is of the multiple-unit type, so arranged that by the addition of more operators' positions the ultimate toll business of Cedar Rapids can be handled.

In the terminal room of the exchange building are located the main and intermediate distributing frames. Also in the terminal room is a relay rack which accommodates the line and cut-off relays. These relays are protected, as may be noted in the illustration, with dustproof metal covers. When these covers are removed the relays become readily accessible.

The power board, which is constructed of Monson Maine slate, is shown in the same room with the power plant and the frames. Instruments are mounted on this board for measuring the charging and discharging current and voltages. It also contains automatic circuit-breakers and fuses for protection, as well as other regulating devices for controlling the supply of energy. A motor-generator set of a type constructed especially for the noiseless charging of storage batteries is used in this power equipment.

The equipment of the storage batteries furnished with this exchange has sufficient reserve capacity to carry the telephone office for forty-eight hours in case of accident to the outside power system.

Wireless in French Colonies.

A scheme for establishing a network of wireless telegraphic communication throughout the French colonies and dependencies in north and northwest Africa has been proposed and may, perhaps, be carried out in a short time.

Wireless telegraph stations have already been established at Oran and Bizerta on the north coast and at Port Etienne, Dakar and Rufisque on the west coast. Additional stations are being constructed at Timbuktu, Konakry and Monrovia. The erection of stations for military purposes at Figuig, Loango, Libreville and Brazzaville and at Abeshr in the Tchad region is planned. All these stations will ultimately be linked up with the Eiffel Tower. It is proposed to establish communications by wireless telegraphy between Port Etienne and the South American continent.

Telephone Reforms in Paris.

Among a series of reforms for regulating the use of telephones in Paris, recently announced by M. Millerand, the Minister of Public Works of France, are the following: Alteration of the telephone directory, allowing subscribers to insert their vocations, office hours, etc.; abolition of the rule empowering the superintendents to deprive a subscriber of all communication without warning or explanation.

The electric treatment of ores is the subject of a booklet forwarded by Consul-General Henry Bordewich, of Christiania, Norway, and which may be examined at the Bureau of Manufactures, Washington, D. C.

A TYPICAL RATE PROBLEM IN SMALL TELEPHONE PROPERTIES.—III.

BY FRANK F. FOWLE.

The item of accounts receivable is somewhat large and shows one of the difficulties frequently encountered in operating such properties. Cash is sometimes scarce in farming communities, at certain seasons, and credit is asked for. This means an increase in expense to the company, however, because it must have the necessary funds for conducting its operation, which have perhaps to be borrowed at a stiff rate of interest.

An examination of the liabilities reveals another condition which is peculiar to small public-utility companies. The outstanding stock and bonds amount only to $18,000; the floating debt amounts to $3,000 and the surplus of $4,923 has also been expended in building up the property. This indicates either a mistaken policy in not increasing the capital with the enlargement of the property, or the inability to sell the company's securities. The latter is frequently the difficulty. The securities of small companies are almost never listed on stock exchanges and as a rule have a very limited or local market. For this reason it is probably fair to permit such companies to learn a larger net return (so as to attract capital) than a large company whose securities have a more extended balance.

The balance sheet may now be revised to show approximately the real condition of the property. Before doing so, however, it should be noted that no specific provision has been made for depreciation.

An appraisal should show two things. One is the reproduction value or first cost of the property, and the other is the present or depreciated value. In this case it will be assumed that the property as a whole has depreciated twenty per cent. This percentage of the the physical property, from Table III, equals $4,960, and is the sum which should be in the depreciation reserve fund at the date of appraisal.

The plant account may be obtained from Table III, excluding from the total the value of land, buildings, furniture and fixtures, tools and teams, and stores and supplies. This equals $19,-

500. To this should be added the allowances and the cost of organization (from Table IV), or $2,600, making the total plant account $22,100.

TABLE VI.

REVISED BALANCE SHEET SHOWING TRUE FINANCIAL CONDITION OF PROPERTY ON THE DATE OF APPRAISAL.

ASSETS.	
Plant Account	$22,100
Real Estate and Buildings	3,900
Furniture and Fixtures	300
Tools and Teams	600
Stores and Supplies	500
Accounts Receivable	2,649
Cash	583
Total Assets	$30,632
LIABILITIES.	
Capital Stock	$ 8,000
Bonds	10,000
Bills Payable (Notes)	3,000
Accounts Payable	183
Accrued Interest	150
Depreciation Reserve	4,960
Surplus, Profit and Loss	4,339
Total Liabilities	$30,632

The revised balance sheet, in Table VI, shows the true state of affairs. The amount of the accounts receivable is partly offset by the accounts payable and accrued interest, leaving a net tsset of $2,316. This last amount is the extent of surplus funds tied up in outstanding accounts. The balance of the surplus fund or $2,023, has been expended on the property, to provide plant and working capital. The amount of the outstanding notes, $3,000, and the amount of the depreciation reserve fund, $4,960, have also been expended on the property. Or otherwise stated, a total of $9,983 has been expended on the property from sources other than the sale of the company's securities. Such a course is commonly a hardship on the stockholders to some extent, and is at best a makeshift; the ultimate day of new financing cannot be avoided. In the present instance the company needs about $10,000 to pay notes, provide a cash depreciation reserve, and distribute surplus profits among the stockholders to the extent that they have been deprived of dividends in order to create the surplus.

A company with such a plant, however, needs a moderate cash surplus to provide against the contingency of sleet storms, if these commonly occur. And it is part of prudence in management to make a small annual charge against revenue to provide a special reserve fund to meet this contingency. The amount to be set aside for the purpose can be told only from experience, and depends upon the usual severity of such storms and the ability of the distribution system to withstand them. An annual charge equal to three per cent of the value of the outside plant would probably be not far from sufficient; in this case that would amount to $323 per annum. This amount may not seem sufficient to some, but it is generally true that the older parts of the plant are most affected, and since they are already much depreciated, their remaining value is not large. In every case of extensive damage from a sleet storm, such as the failure of half a mile of pole line or more, there is always present the question of what part of the cost of rebuilding is chargeable to maintenance, and what part to depreciation. If the line is new, it is all chargeable to maintenance; if it is so old as to have needed rebuilding anyway, it is all chargeable to depreciation; if it is not new, but yet serviceable for some years under normal conditions, it is chargeable in part to maintenance and part to depreciation, in the proportion respectively of present value and extinguished value, the latter term meaning the loss in value through depreciation.

For example, suppose a portion of line fails which cost $1,000 and which has a present value of $600 (sixty per cent of $1,000). Suppose further that it costs $1,200 to rebuild it. This amount of $1,200 is then chargeable as follows: Sixty per cent, or $720, to maintenance, and forty per cent, or $480, to the depreciation reserve fund. This method of charging is necessary in order to maintain the proper amount of the depreciation reserve, and not to load current maintenance with reconstruction charges. The common method of charging such repairs wholly to maintenance results in accumulating a surplus reserve in the depreciation fund and correspondingly depletes the net earnings.

Turning now to the operating accounts, let it be supposed that the results of one year's operations, ending at or near the date of appraisal, disclosed the following revenue, expenses and net earnings. The figures given in Table VII are fairly representative.

Table VII shows a ratio of expense to revenue, which is commonly termed the operating ratio, including taxes, of 79.4 per cent. This is high in comparison with the ratio usually found in well managed utility companies. It is noteworthy also that there are no charges for depreciation. The rate of net return, after taxes are paid, upon the property valuation of $28,000 is 8.75 per cent, which is not adequate to cover depreciation and provide a reasonable profit. This is a condition which may be found in small utility properties, not confined alone to telephone systems. The manner of its origin has already been touched upon, and we shall next consider what schedule of rates produced the revenue in the present instance and determine the schedule which should be substituted for it.

TABLE VII.

STATEMENT OF ANNUAL REVENUE, EXPENSES, CHARGES AND NET EARNINGS.

Revenue from rentals	$	$7,030
Operating expense	2,560	
Maintenance expense	2,820	5,380
Earnings		$1,650
Taxes	$ 200	
Bond interest	600	
Note interest	180	980
Net earnings		670
Dividends, 6 per cent		480
Balance		$ 190
Previous surplus		4,733
Present surplus		4,923

The first step in this process is an examination of the subscribers' record to ascertain the classes of service furnished, and the number of subscribers in each class. This is exhibited in Table VIII.

TABLE VIII.

CLASSIFICATION OF SUBSCRIBERS.

Class of Service	Subscribers Business	Residence	Total	Lines
Single line	60	15	75	75
Party line		175	175	60
Farmers' line		250	250	30
Total	60	440	500	165

The rate schedule is next in turn for consideration. The application of the schedule to the number of stations shown in Table VIII will indicate the annual revenue from rentals, on the basis of the development existing at the date of appraisal. As regards rate schedules in general it may be said that flat rates are almost universal in such properties, and they are more equitable under the conditions as a rule than measured service, and much more satisfactory.

TABLE IX.

SCHEDULE OF EXISTING RATES AND ANNUAL REVENUE THEREUNDER.

60	single-line business stations at $21	$1,260
15	single-line residence stations at $18	270
175	party-line residence stations at $15	2,625
250	farmer-line stations at $12	3,000
500	Total stations	$7,155

The schedule of rates presented in Table IX is representative in general of the rates under which many small com-

panies are operating. Some companies are operating with even lower rates, as low as six dollars per year for farmers' line stations. That such rates are frequently unremunerative will appear later. It is improper, of course, to condemn any schedule of rates before the local conditions are fully understood and analyzed, except where they are so high or so low as to be illogical. The conditions in neighboring or smaller localities are sometimes alike, but frequently they are not, and conclusions drawn from general comparisons are dangerous, to say the least.

The determination of the gross revenue which our hypothetical plant should earn will be completed by fixing the amount of interest or profits, and the charges for depreciation. What constitutes a fair rate of profit or interest upon an investment was well covered by a cardinal principle laid down in the decision of the Supreme Court in the Consolidated Gas Case (New York), as follows: "There is no particular rate of compensation which must, in all cases and in all parts of the country, be regarded as sufficient for capital invested in business enterprises." The court in that case held six per cent to be a fair rate in view of the moderate risk involved in the gas business, conducted on a very large scale in the city of New York. In our case we have a situation wholly unlike that referred to, the community is different, its resources and wealth are less and the risk is greater. A return of not less than eight per cent is probably necessary to attract capital in most cases; but most investors would consider this an abundant return if it were practically certain to be maintained and if their principle were secure. A return of eight per cent on the estimated valuation of $28,000 amounts to $2,240 per annum.

The methods of determining depreciation differ somewhat; some engineers apply a lump percentage to the whole plant, others treat the different parts separately. The latter method will be used here, assuming the straight-line theory of depreciation, and further assuming that four per cent interest will be allowed upon the annual contributions to the fund. The method of computing depreciation in detail is much safer than allowing so much per annum per line or per station, or a lump per cent on the whole plant. The calculations in detail appear in Table X, based on the detail valuations given in Table III.

TABLE X.

ESTIMATED ANNUAL DEPRECIATION.

	Estimated Life in years.	Annual Rate.	Actual Charges—Gross Amount.	Per Line.	Per Station.
Land	..	....	....	....	....
Buildings	50	.5%	$150	$0.91	....
Central Office Equipment	10	8.2%	123	.75	....
Distribution System	12	6.5%	130	.79	....
Telephones	10	8.2%	287	....	$1.15
Farmer Lines	12	6.5%	569	18.97	....
Farmer Line Telephones	12	6.5%	244	....	.98
Furniture and Fixtures	10	8.2%	25	.15	....
Tools and Teams	6	15.0%	90	55	....
Stores and Supplies	..	5.0%	25	.15	....
Total			$1,643		

The total annual charges for depreciation are $1,643, which equals 6.63 per cent on a valuation of $24,800, or 5.87 per cent on $28,000. This is a high rate of depreciation as compared with the rate on other kinds of public-utility plants, but it implies no weakness in the value of telephone securities if the financial policy is a sound one and the rates are adequate. The estimated life of various parts of the plant, as above given, is assumed to include with physical depreciation the effects also of obsolescence and inadequacy and further assumes the character of construction and materials that was formerly somewhat prevalent, as not of the best now available. The life of a modern plant ought to be rather greater.

The total sum of operating expenses and fixed charges may now be set down, for comparison with the estimated revenue under the old rates of Table IX.

TABLE XI.

ESTIMATED NECESSARY REVENUE.

Operating expense	$2,560
Maintenance expense	2,820
Taxes	200
Depreciation	1,643
Sleet storm insurance	323
Interest	2,240
Total	$9,786

This estimated gross revenue of $9,786 compares with $7,155, from Table IX, the latter being insufficient by twenty-seven per cent to meet all expenses and charges and return eight per cent on the investment. Or, in other words, the old rates produce a revenue hardly sufficient to meet all expenses and provide properly for depreciation. The operating ratio, computed from Table XI, is fifty-seven per cent, as compared with 79.4 per cent under present assumed conditions.

This determines that the old rates are inadequate as a whole, and the last feature of this study becomes a discussion of how to apportion the gross revenue among the several classes of service so as to establish a schedule of equitable and remunerative rates. The apportionment of expenses in a small system is difficult and becomes a matter of estimate and judgment at best, because so many expenses such as salaries, supplies, etc., are not apportioned in the accounts. Indeed, it is difficult to apportion them justly without a great deal of labor and frequent adjustment. The operating expense of $2,560 per annum is not strictly proportional either to the number of stations or to the number of lines, but much nearer to the former than the latter. It will here be assumed as strictly proportional to the former, and amounts to $5.12 per station. The annual maintenance expense of $2,820 will be apportioned to the plant in the ratio of plant values, an assumption that is not of course strictly correct, but sufficiently accurate for our purpose; this appears in Table XII.

TABLE XII.

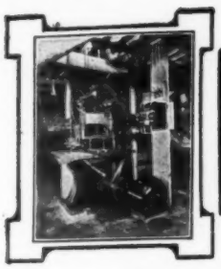
APPROXIMATE DISTRIBUTION OF MAINTENANCE EXPENSE.

	Gross Amount.	Actual Charge—Per Line.	Per Station.
Buildings	$ 376	$2.28	....
Central Office Equipment	188	1.14	....
Distribution System.	251	1.52	....
Telephones	438	....	$1.75
Farmer Lines	1,097	36.57	....
Farmer Line Telephones	470	....	1.88
Total	$2,820		

Wireless Telegraph Station at Colon.

There has been installed in the United States Navy Wireless Telegraph Station at Colon a complete new wireless telegraph equipment including antenna. The new equipment consists of the latest improved design of Fessenden apparatus.

The transmitting apparatus is of the high frequency 500-cycle type, with rotating spark gap attached to a generator of twenty-five kilowatts capacity. Two compressed air condensers, each operating under 250 pounds air pressure are also used. The transmission ranges on this apparatus include Washington, D. C., Norfolk, Va., New Orleans, Key West and Guantanamo. Power for operating the transmitter is received from the Isthmian Canal Commission plant at Gatun. These equipments were put in operation March 1 and have operated satisfactorily.



Industrial Power

NOTES ON THE ERECTION AND MAINTENANCE OF ELECTRICAL PLANT AT A GOLD MINE.[1]

BY W. ELSDON DEW.[2]

The generating plant at a mine, up to within the last few years, has not been of such large dimensions as it might have been, and now owing to the electric current supply being about to be taken from the large power company, many generating plants are being scrapped. Many a lesson can be learnt from the old plants, however, and I will call attention to points on which various past experiences would be interesting.

The continuous-current generator of past years (say ten years ago) no doubt calls to your mind nightmares which you hope never to see again, yet it has been only in the details of design and the consideration of finding the position of sparkless commutation, that now finds this machine as reliable as any. One can still look around and see generators of the old types in operation that have brush gear requiring most careful and regular adjustment to secure reliable service. Peculiar contrivances that have been adopted can also be seen which, though not universally known, have given better service than before their adoption. The development of the carbon brush and brush-holder has brought forth a reliable means of collecting the current that was a source of trouble formerly. I can call to mind an instance where, though it was possible to get sparkless operation with wire-gauze brushes, yet the cost of the constant and skilled attention necessary was prohibitive, and I have found also that with carbon brushes there would have been trouble on account of there not being enough rubbing contact to allow of carbon being used. This is an instance where special carbons might have succeeded.

It has come to your notice, no doubt, that the greater resistance in carbon brushes causes a slight voltage reduction, and this resistance is taken advantage of in the development of the graded carbon. In this way certain manufacturers of carbon brushes now profess to be able to make carbon brushes which will overcome all sparking in the worst of machines, if the commutator is suitably built for carbon brushes; that is, the insulation between segments must be suitable.

There are causes of sparking, and development of sparking, which must not be overlooked, one of which is vibration, for even the joint in a belt has been the cause of a developed sparking. Vibration also has most detrimental effects in the jointing up of the windings to segments. Slack connections and irregular collection of brushes on multipolar machines are not to be overlooked as a cause of sparking. Continuous-current armatures subject to momentary overloads may develop faults due to the shifting of coils and binders. Instances where damaged armatures have been repaired and coils cut out and kept in use may be forthcoming. The successful operation of shunt-wound generators working in parallel is perhaps an old subject, but it has happened that some trouble has not been traced, and a fault has developed through a faulty switchgear and the arrangement of the same, that allow of an irregular sequence in operation.

The alternator as a single unit will give but little trouble in itself if the exciting current is reliable and under control, but when worked in parallel there are points that are not quite apparent to most. It has, no doubt, been the cause of trouble to some to find that the alternator was not doing any more work, although the exciting current was increased, and incidentally, the apparent load as indicated by the ampere meter. Such a condition would cause trouble if the operator did not realize that the alternator is quite different to the continuous-current generators, and that voltage regulation was not all that was necessary for taking up or putting off load. Though a number of continuous-current generators can be successfully operated in parallel when driven from one line shaft, operation of alternators in similar manner is anything but successful, if the loads on the machines are to be varied, and if machines are to be taken out or put into service as the whole load varies.

The prime mover in the case of the generating plant is, perhaps, the cause of more trouble than is at first apparent, and also in having governors that do not respond to sudden changes. Further, if the prime movers are not working in unison or sympathy with one another, the irregularity of service may be so bad as to cause interruptions. When the governors of the prime mover are not responsive to sudden changes, it may even be necessary to resort to the artificial loads which are cut out of use when the motor comes into work, so that the whole plant is not disturbed. This is not an expensive way of overcoming such difficulties when the prime mover is driven by natural sources of water power, but in the case of steam or other sources of power, it may be considered out of the question, and an equalizer, either in the shape of a heavy flywheel or storage battery, may be necessary, if the governor trouble is insurmountable, a point which I do not confess to be at all possible.

It is no doubt quite apparent that it is advisable to have the prime mover of the generating plant independent of other machinery, for a hanging up of the electric supply through causes that may be quite out of the control of the attendant is likely to cause serious trouble to the other plant, and more

1. Abstract of a paper presented at the third ordinary general meeting of the South African Institute of Electrical Engineers, Johannesburg, S. A., March 10.

2. Vice-president of the South African Institute of Electrical Engineers.

especially if the underground pumping is dependent on it.

The advisability of recording instruments for the successful operation of the whole plant is a subject that is worthy of much thought, and if the plant is large enough, these instruments will soon pay for themselves. Successful operations under adverse conditions may result from the observation of records which would not otherwise be observed by the attendant. The Tirrill regulator has done much for the successful regulation of plants, but as these regulators are expensive, their adoption is not always necessary if the supply does not necessitate very close regulation. I have found a kafir at $1.80 a month not a bad regulator during times of intermittent loads. The use of earth detectors on the main switchboard is not to be neglected, for besides indicating any changes, they can be used for tracing the fault in individual feeders. The power-factor instrument also can be used to advantage and should not be neglected. It is perhaps unnecessary to speak of the necessity of placing continuous-current instruments out of the influence of stray magnetic fields, but these are matters which in the days when less was known of the subject that caused trouble. There are, no doubt, other instances of corresponding effects that some may be able to recount.

Through the use of current transformers, some of the troubles in switchboards, incidental to the use of alternating current, have been somewhat overcome, but the placing of wires without sharp bends, and also so fixed that there can be no drawing together through overloads, must not be overlooked. Such instances have been perhaps the cause of many troubles, and have not always been traced at once. The effects of surges, even in small plants, might also have been noticed, as this is a subject on which little has been written and there is still a great deal to be learned.

The subject of motors and their application to work is one on which a variety of opinions may be obtained. Taking first the continuous-current motor, we are confronted with the various types in use such as shunt-wound, series-wound, and compound-wound. I had the pleasure of seeing through the workshops of the Natal Government Railways recently, and there the application of the continuous-current motor is a lesson in itself. There are in those shops over 450 motors, and by having voltages of fifty, 110, 220, 330 and 440, which are obtained by the use of balancers for the supply of different voltages, a variety of speeds for the tools that is at once most useful and economical is obtained, and they are an object lesson in simplicity of working. I made special inquiry as to the number of staff necessary for the upkeep of such a large number of motors, and was informed, that in addition to the native cleaners, there were but two electricians and two or three learners who kept the whole plant and wiring in order, and did all armature winding.

The series motor has advantages peculiar to itself which has placed it in the most successful operation of electric motive power, such as the propelling of tramcars and for use in hoists, etc., where starting torque is of such great importance.

The successful operation of all continuous-current motors necessitates careful attention to the field, for from the neglect of this may arise difficulties in the armatures which may ultimately result in failures. The devices in operation for the protection of the windings caused by the breaking of the current in a highly inductive circuit will be of interest, and are not always appreciated by the manufacturers.

The three-phase motor has forced itself to the front by its simplicity in construction, yet there are quite a variety of styles of winding with which one is meeting, that the opinion of those who have to work with them will be of value.

The squirrel-cage motor, where it can be kept constantly moving, is hard to beat for simplicity and mechanical strength, but the objection to the starting current necessarily precludes it from certain work where stopping and starting is continually going on, and where the load is such that the current necessary to get the motor under way is excessive. The introduction of autostarters at once reduces one of the chief advantages that is claimed for the squirrel-cage motor, and any means of introducing resistance into the rotor circuit at once brings down the efficiency to such an extent that the wound rotor will easily show up to greater advantage in comparison. The jerk that accompanies the starting of squirrel-cage motors is also an objection on a small plant, and is so detrimental to the driven machinery that I do not doubt that the subject of maintenance generally will be seriously affected. In referring to the autostarter, which is a means of distorting the phases for the sake of obtaining greater torque, the disturbance that this has caused to the power-factor of the system has no doubt been brought to your notice. The induction motor with wound rotor is now extending its sphere of operations, so that the most difficult problems are being tackled, and yet it is still to be proved if due allowance has been made in the rotor windings for heating effect while starting is taking place. The liquid starter has placed the induction motor with wound rotor in a position for competing with other motors which the advocate of three-phase work has long since recognized, and with special work by a combination of connections, one can obtain most excellent work from this type of motor. The systems of many motors in cascade and multiple series for special work do not offer a difficult problem. We have, perhaps, but few slow-speed motors, which is to be regretted, for the successful operation of slow-running machinery should not be handicapped with this extra loss through speed reduction by means of belts or gearing.

The heating of motors is of such importance that the causes should be specially looked into and the necessary precautions adopted. The motor panels, and the instruments with which they are equipped, deserve a little more consideration, and a three-phase motor having a trip coil on one phase only for overload is not having the protection it deserves. The question of vibration is one of the chronic diseases that a motor is subjected to by being erected on insecure foundations.

The subject of the history book and records of departmental costs is one that we would like to see carried out with more sympathy from the clerical staff at a mine. Its use would soon lead to economies which would repay the first trouble of its inauguration very quickly. These records must be made up so as to appeal to the heads of departments, and not slumped up in the mines working costs, which are made up for general comparison amongst mines.

VOLTAGES FOR VARIOUS SPARKING DISTANCES.—(1) Please publish a table giving the voltage for various lengths of spark. I have a table giving the values up to six inches. What length of spark corresponds to 400,000 volts? (2) I would like to know how to compute the voltage in the secondary of a transformer or spark coil when the number of turns is not known.—C. O. S., Los Angeles, Cal.

(1) In the standardization rules of the American Institute of Electrical Engineers is given the following table of sparking distances in air between opposed sharp needle-points:

Kilovolts	Inches	Kilovolts	Inches
5	0.225	140	13.95
10	0.47	150	15.0
15	0.725	160	16.05
20	1.0	170	17.10
25	1.3	180	18.15
30	1.625	190	19.20
35	2.0	200	20.25
40	2.45	210	21.30
45	2.95	220	22.35
50	3.55	230	23.40
60	4.65	240	24.45
70	5.85	250	25.50
80	7.1	260	26.50
90	8.35	270	27.50
100	9.6	280	28.50
110	10.75	290	29.50
120	11.85	300	30.50
130	12.90		

If this table were continued it would be found that 400,000 volts corresponds to a spark length of about 40.50 inches.

(2) Without a knowledge of the number of turns in the transformer it is impossible to compute the secondary voltage, unless the ratio of the numbers of turns in the primary and secondary coils is known. The secondary voltage bears the same ratio to the primary voltage as the secondary turns to the primary turns. This is not true for any form of induction coil, however, because in that case the ratio of voltages is also dependent on the speed with which the primary current is broken.

ALTERNATING-CURRENT AND DIRECT-CURRENT ELECTRIC-LIGHT WIRING.—In wiring a house for electric light can the same wiring be used for both alternating current and direct current without any changes whatever? If not, please state difference in the wiring.—P. A. F., Chicago.

Electric-light wiring obeys the same rules as to size and kind of wire, etc., for alternating-current as for direct-current systems, with the following difference as to the manner of installation: When iron conduit is used to protect the wires in an alternating-current installation both the wires of any single-phase circuit are run in the same conduit. This also holds for the three or four wires of any two-phase or three-phase circuits and is for the purpose of preventing excessive inductive drop. This is not necessary in direct-current circuits, and in such circuits the two wires may be run in separate conduits. However, it is advisable even then to put both wires in the same conduit, as any subsequent change from direct current to alternating current may be brought about without any changes in the wiring.

ENERGY CONSUMPTION OF LAMPS; LIGHTING RATE; POLARITY OF EQUALIZER.—(1) Please tell me how to figure the kilowatts consumed by any certain number of lights, or the kilowatt-hours, whichever the electric-light companies use in making up their bills. (2) Also what is the cost per kilowatt or kilowatt-hour in this city? (3) Why is the equalizer cable of a 2,000-kilowatt rotary converter on the negative side of the machine instead of on the positive side as on steam-driven dynamos?—F. A. B., Chicago.

(1) The energy consumption of electric lamps depends chiefly on the type and size of the lamps and on the voltage of the circuit to which they are connected. Incandescent lamps run much more closely to certain average values than arc lamps. The commonest of the older carbon incandescent lamps required between fifty-five and fifty-six watts per sixteen-candlepower, 110-volt lamp, so that practically eighteen such lamps would require 1,000 watts or one kilowatt of power; therefore when burning one hour eighteen such lamps consume one kilowatt-hour, or one lamp burning eighteen hours consumes one kilowatt-hour of energy. It takes twice as much power to burn a thirty-two-candlepower carbon lamp, so that such a lamp burning nine hours consumes one kilowatt-hour. The newer tantalum and tungsten lamps are usually rated in watts, so that a forty-watt lamp burning twenty-five hours consumes one kilowatt-hour; similarly ten 100-watt lamps consume one kilowatt-hour for each hour they are burning. These are only approximate methods of figuring the energy consumption of lamps, since no account is taken of the voltage. Actually a watthour meter is used by most companies to measure the exact energy consumption in kilowatt-hours. (2) In Chicago the rates for electric lighting by the Commonwealth Edison Company are as follows: (a) Thirteen cents per kilowatt-hour for all electricity consumed in each month up to and including an amount that would be equal to thirty hours' use of the consumer's maximum demand in such month; (b) seven cents per kilowatt-hour for all electricity consumed in such month in excess of that amount; (c) a discount of one cent per kilowatt-hour is allowed on the total monthly consumption when bills are paid within ten days. (3) The equalizer may be connected on the negative side just as well as on the positive side of rotary converters and dynamos, provided that all machines operating in parallel in any station be connected in the same way. If one has the equalizer on the negative side, all must have it on the negative.

VOLTAGE ON PACKING-HOUSE CIRCUITS.—I have been informed by a packing-house man that no higher than 115 volts is ever used on packing-house circuits. Is that true?—H. D., Fort Dodge, Iowa.

It is quite common to use 220, 250, 440 and 500 and even 550 volts on packing-house circuits. For the various motor circuits all of these voltages have been used in different stock-yards installations. While 110 or 115 volts is the more common for lighting circuits, 220 or 230 volts has been used in many plants. For industrial railways connecting the buildings of some plants 500 to 550 volts direct current is used on the trolley. The lighting and power circuits are in some instances direct current and in others alternating current.

New Electrical and Mechanical Apparatus and Appliances.

Storage Batteries for Emergency Service in Central Station Work.

The use of storage batteries in central stations for emergency service is of quite recent origin, but so satisfactory were the first sets that the number of installations has been enormously increased. Only a year ago, at the annual convention of the National Electric Light Association, the point was brought out that the Electric Storage Battery Company, of Philadelphia, had only one of its "Exide" batteries in use for this service. That installation was at the Thirty-ninth Street Substation of the New York Edison Company. At the present time emergency "Exide" batteries have been contracted for by five of the larger Edison companies.

The total output of these five batteries, figuring only the number of plates first installed where larger tanks are contracted for, is 205,550 amperes for twenty-one minutes, at about 120 volts, or 24,660 kilowatts. For the six-minute rate of discharge the output is doubled.

A battery with this capacity can take care of a large portion or all of the load, during the short periods of interruption which are liable to occur in any large generating system, and it is to meet the demands of emergency service that the "Exide" battery has been designed. Figures given in a recent bulletin prepared by the Electric Storage Battery Company show that the "Exide" battery will give an output of from two to three times that of the Manchester type.

Dixon Crucible Company Meeting.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company, the old board consisting of Geo. T. Smith, William Murray, William H. Corbin, Edward L. Young, Geo. E. Long, William H. Bumsted and Harry Dailey, was unanimously re-elected. The board of directors re-elected the former officers, namely, Geo. T. Smith, president; William H. Corbin, vice-president; Geo. E. Long, treasurer; Harry Dailey, secretary; J. H. Schermerhorn, assistant treasurer and assistant secretary. William H. Corbin was also re-elected as counsel.

A New Pipe Threading Machine.

The motor-driven pipe-threading machine shown in the accompanying illustration is one of several recently installed by the Stoever Foundry and Manufacturing Company of Myerstown, Pa., at the pipe mill of the Spang-Chalfant Company, Sharpsburg, Pa. The capacity of the machine is from four to twelve inches inclusive and interest of the installation lies in the fact that the pipe threader is the fastest machine for threading or cutting pipe on the market. It is threading pipe at the rate of 28 feet per minute; a very fast speed for a tool of this size.

MOTOR-DRIVEN PIPE THREADING MACHINES.

The machine is driven by a Westinghouse type "MS" squirrel-cage induction mill-motor, which has the rugged construction and the general reliability required for such service. The normal rating of the motor is ten horsepower, and the full load speed is 875 revolutions per minute on a three-phase, twenty-five-cycle, 200-volt circuit. Squirrel-cage induction motors of suitable design are especially appropriate for this class of service, since the speed is constant and there are no sliding contacts. The motor here shown has the distinction of being the first squirrel-cage induction motor designed especially for heavy mill service. The only wearing parts are the bearings, which are very large, rigid and self-oiling, and capable of maximum service. The motor is started by means of a Westinghouse auto-starter.

The pipe-threading machine has ten speeds; the gear box gives five changes, and a double train of gears outside of the box two speeds for each one in the box. All of the gears are made of carbon-steel castings and are fitted with bronze bushings. The gears that are subjected to the most wear have case hardened teeth. All the gears run in oil. A number of changes in speed can be made without stopping the machine and the machine can also be started or stopped by means of a clutch on the operating side of the tool. The gearing is on the outside of the machine and accessible to the operator.

The bed of the machine is so designed and constructed as to give a very stiff and strong cross section. The bed is supported on the outer ends by suitable legs, and under the headstock by a very heavy pedestal base that strongly supports the entire driving mechanism of the machine. The headstock of the machine is made in one casting, similar to that of a lathe, this one casting containing all the principal bearings, which insures permanent alinement and

great rigidity. The spindle or arbor of the machine is of such a diameter on the inside that the largest sized fittings within the capacity of the machine can be passed through.

There are provided two gripping chucks of unusually heavy design, made in one piece without any separate parts or faceplates. Each chuck has three independent jaws operated by powerful screws. These jaws are made of steel and are equipped with hardened steel plates for holding the pipe.

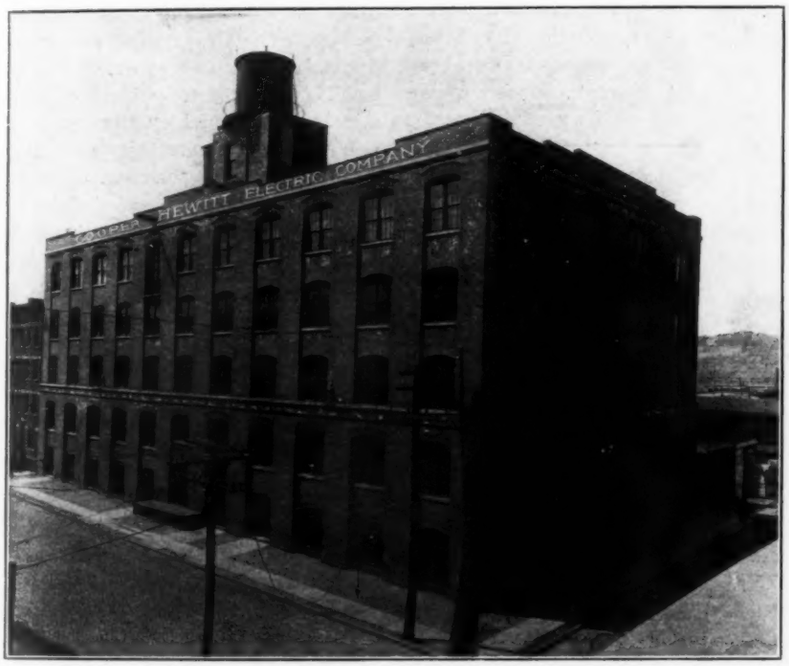
The die head is of the sliding or floating type that allows for any eccentricity in the pipe. The die head can be pushed to one side and pipe cut off at a distance of three inches from the face of the front gripping chuck. This type of head permits inserting the pipe from the front or rear of the machine without injury to the dies. Rounding blocks are provided for rounding the pipe before it is threaded.

The oil pump on the machine is of the geared type and is driven direct from the constant-speed shaft. Valves are placed at both the die head and the cutting-off tool to regulate the supply of oil at these points. All surplus oil flows back into the reservoir in the bed of the machine through a relief valve.

All of the bearings of the pipe threader are provided with long and deep receptacles for holding lubricating wool and oil

New Factory of the Cooper Hewitt Electric Company.

The demand for Cooper Hewitt lamps has, according to the manufacturers, entirely outrun the capacity of the New York City factory. For some months past the present works have been so congested with orders that it has required heroic efforts to give the prompt service which the Cooper Hewitt Electric Company has always made one of its basic business principles. For several months the company had been looking for a suitable site or building and has recently purchased the substantial structure that is located at the corner of Grand and Eighth Streets, Hoboken, N. J. The new location affords the advantages of the best of light and air, and the railroad and shipping facilities are equal to those of the metropolis; recent rapid transit facilities place the building within twenty minutes' ride of either the financial or uptown sections of New York.



NEW FACTORY OF THE COOPER HEWITT ELECTRIC COMPANY.

The new factory, shown in the accompanying illustration, will be equipped as rapidly as possible with the most modern machinery and devices for the manufacture of the Cooper Hewitt lamp. Power and electric current will be supplied by the Public Service Corporation of New Jersey. The new alternating-current type of Cooper Hewitt lamp will be the first to be manufactured in the new plant. The work on this lamp will begin as soon as the requisite machinery and apparatus can be installed.

The building has four stories and a basement; the total floor space is 60,000 square feet. The building is divided in the center of its length by a sixteen-inch fire wall, all openings in which are guarded by sliding fire doors equipped with low temperature fuse releases. An elevator gives access to all floors on either side of the fire wall. The entire building is equipped with a combination gravity and pressure sprinkler system. The machine department will be equipped with electric motors, which will be arranged for individual and group drives.

While no efforts have been made on the part of the Cooper Hewitt Company to carry on a spectacular selling or publicity campaign, the lamp has steadily increased in popularity and sales, and has always kept the factory facilities employed to the full. The Company has followed a wise policy of conservation, believing that a mistake avoided is far better than a mistake patched up. The Cooper Hewitt lamp has undergone improvement in details in the natural course of development, and as a consequence of the greatly enlarged facilities afforded by this new plant, a more aggressive sales policy may be expected, so that the merits of the Cooper Hewitt lamp will become more widely known and used.

Western Electric Exhibit.

The Western Electric Company was well represented at the convention of the Pennsylvania State Engineers' Society, held in Harrisburg on June 1, 2, 3 and 4.

An exhibit of telephones, including interphones, mine telephones and an artillery telephone set and a line of Hawthorn motors, exhaust fans and transformers, together with street railway and sundry electrical supplies, was shown at Harrisburg.

The following members of the Western Electric sales staff at Philadelphia were in attendance at the convention: A. L. Hallstrom, sales manager; W. D. Lindsey and J. W. Alexander, of the Telephone Department; H. C. Robinson and L. R. Lewis, of the Power Apparatus Department; J. R. Stuard, F. C. Jaeger and G. F. Livezey, of the Supply Department, and J. L. Ludwig, street railway specialist.

A New Conduit for Underground Cables.

A new cable conduit recently placed on the market by the H. W. Johns-Manville Company, New York, known as "J-M Fibre Conduit," is especially noteworthy because of some features new in the manufacture of conduit.

This conduit is made of indurated fibre, a material which has been used very extensively for insulating purposes, such as third-rail coverings, controller linings, battery boxes, etc. Water pails, etc., have also been made of it for many years.

In making J-M fibre conduit, the fibre is moulded into shape under high temperature and immense pressure, and is entirely without grain or laminations. This process gives each length of conduit a solid, three-eight inch one-piece wall, homogeneous, with tensile strength that is remarkable when compared with the light weight of the conduit.

But the most interesting feature of this new conduit lies in the bell joints shown herewith. One end of each section is moulded to an enlarged size, belled out, with an opening as large as the outside diameter of the opposite end of the next section. Thus, any two sections fit together without any reduction in the wall thickness of either section at the joint.

Realizing, however, that installation methods on some systems have been devised which necessitate the use of straight joints, the manufacturers have also arranged to make this new conduit with straight line joints, as shown in an accompanying illustration.

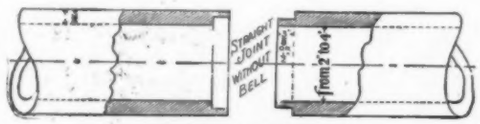
The joints in this new conduit are smooth inside as they are machine moulded and true, having no offset. Each length of the conduit is also smooth throughout its bore. This greatly facilitates the work of inserting cables.

The manufactures claim that by reason of there being no seams or roughness at the joints of this conduit and as the air-tight joints prevent particles of concrete from seeping through, a No. 6 wire can be pushed through each duct from manhole to manhole, doing away with the ropes and rods.

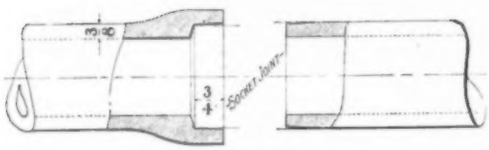
Tests made of this conduit with three-eight inch thickness of wall show that it has an average puncture voltage of 40,800 dry and 33,000 volts after forty hours immersion in water. Danger of electrolysis should therefore be practically eliminated by the use of this conduit.

A variety of fittings such as bends, elbows, tees, etc., provide for bends and curves in the trenches. Two, three and four way junction boxes provide for branch and service connections.

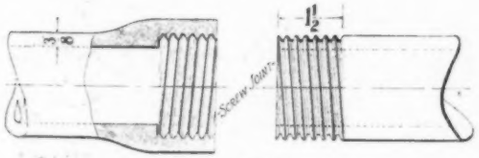
J-M FIBRE CONDUIT.



STRAIGHT JOINT.



SOCKET JOINT.



SCREW JOINT.

DISCONNECTING SWITCH.

Bogus Ignition Parts.

The Connecticut Telephone and Electric Company, Meriden, Conn., will in future place its full name upon all parts of its ignition coils. The company has experienced a great deal of trouble due to the fact that irresponsible manufacturers are placing upon the market imitation parts for Connecticut coils, which are poor imitations of the original. The vibrator blades are much thinner and smaller in diameter than those furnished on the genuine, with the result the coil will fail to act properly.

Some of the spurious parts have been fitted with inferior grade of metal. In some cases German silver and other alloys have been used in place of platinum points, with the result that they would quickly ruin the coil by breaking down, or would cause missing of the engine, and the car would not run with its full power.

High-Tension Weatherproof Fuse and Disconnecting Switch.

With the increasing capacity of central-station distribution systems it is rapidly becoming recognized as good engineering practice to install disconnecting switches at such points as to isolate the various feeders or important transformer installations. To meet these new conditions a number of weatherproof switches have been developed, and a solution of the conditions imposed by modern practice is offered in the combined weatherproof fuse and disconnecting switch shown in the accompanying illustration.

This device has been developed into a commercial switch after having been thoroughly tested in actual operating service. The line conductors are soldered directly to heavy detachable connectors arranged to be fastened to terminal plates, which in turn support a pair of special contact jaws for reception of the fuse chamber. The supporting element is made of iron so treated as to resist weather conditions and of sufficient mechanical strength to minimize danger of breakage during installation. At each end of the supporting frame is located a slot to permit insertion of lag screws to attach the device to cross arms, poles or walls.

On two projecting pins are mounted a pair of petticoat high-tension insulators having great mechanical strength and high insulating qualities. The design and dimensions of the insulators are such that the standard maximum surface or creepage distance is secured and the factor of safety is then doubled by employing designs for double the actual line voltage or test conditions. For example, a 13,200-volt device is equipped with insulators tested for 25,000-volt line pressure and 70,000-volt break-down test.

Fastened at the top of each insulator is a specially designed locking-contact device of such contour that the weatherproof fuse chamber can be inserted in the usual manner. The construction is such that a blown fuse can easily be replaced by the use of insulating tongs, or when desired the entire element can be swung open as a disconnecting switch, thus effectually killing an entire section of line.

The fuse is of the enclosed type and specially constructed to resist weather conditions. The construction is such that the blowing time is practically constant under varying temperature, so that transformers or other apparatus can be thoroughly protected by proper size fuses.

Especial care has been taken in designing this fuse to insure rapid condensation of the expanding gases generated by volatization of the metal during the fuse period and to break up their continuity. This rapid cooling and absorbing, or dissipation, of these gases is of the highest importance and the result, it is claimed, is a fuse which will not only meet the difficult conditions imposed by outdoor service, but also quickly suppresses and prevents holding over of the heavy arc incident to short-circuits and overloads.

Rapid lowering of the gas temperature to a point where their conducting power ceases is also of great importance in preventing danger of explosions which would tend to strain or even destroy the fuse casings. In the design illustrated this feature is further safeguarded by employing a casing having mechanical strength and of such dimensions that internal pressures caused by fusing will not cause damage.

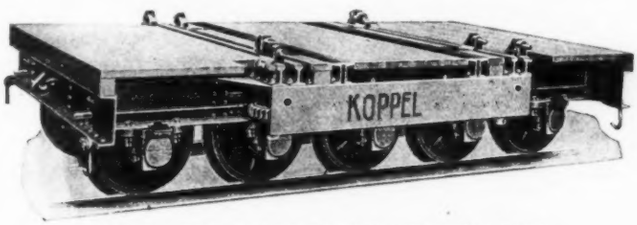
The spacing between contacts conforms to recognized commercial practice, thus eliminating the danger of leakage under operating conditions, or danger to the lineman during installation or inspection. This new device is manufactured by the Delta-Star Electric Company, Chicago, Ill.

TRANSPORTING LARGE TRANSFORMERS.

BY C. P. BLACKISTON.

The transporting of large transformers from one part of a power station to another without a crane is fraught with difficulties. Frequently it is necessary to remove such transformers from the transformer house to a repair shop where work can be done on the apparatus without danger of workmen coming in contact with high potential wires.

In the powerhouse of the Rand diamond mines, South Africa, there are installed several large three-phase transformers of about 5,000-kilowatt capacity weighing eighty-eight tons and also several smaller transformers weighing fifty and thirteen tons. In order to make occasional repairs to these transformers, it is necessary to remove them to a repair shop which is some distance from the transformer house. To do this specially designed steel platform cars, one of which is shown in the illustration, are used. These cars were designed and built by the Orenstein-Arthur Keppel Company, Pittsburg, Pa.



TRUCK FOR TRANSPORTING TRANSFORMERS.

These cars are built of steel throughout save for the wooden platform on top. There are five axles, with roller bearings, to each car, the wheels on the three inner axles being without flanges in order that the car may be able to negotiate easily the curves in the track, which have a radius of about 600 feet. The frame of the cars consists of steel I-beams. Each car has a capacity of ninety tons and weighs seven and one-half tons. The track gauge is three feet six inches.

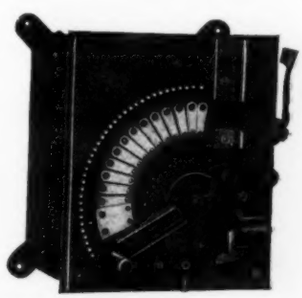
In order to avoid tipping the car when loading the transformers from the side, adjustable screw supports are provided which are lowered and raised by means of worm gears operated from the end of the car. A construction of this kind is necessary on account of the force required to release the supports after the heavy transformer is on the car. These screw supports, when lowered during the loading process rest on brick work projections in the transformer building.

The transformers are secured in position on the car during transportation by means of special catches which lock the wheels of the transformer trucks to the rails. The hooks shown in the end frames of the car are used to hold it stationary while being loaded and connect to links set in the brickwork of the building.

The wooden platform enables the car to be used in other than transformer service when desired. Its entire construction gives great strength with comparatively light weight, while the roller bearings enable to to be propelled with minimum amount of power.

An Improved Type of Speed Controller.

The intense competition of the present day makes imperative the greatest economy of time and labor. High speed machinery and skilled workmen are absolutely essential in order to meet competition and produce the high grade product demanded. Defective apparatus, such as a tool, its driving motor, or the motor controlling apparatus, will produce a loss in production, and in a large shop or factory this loss will be large unless absolutely reliable apparatus is used.



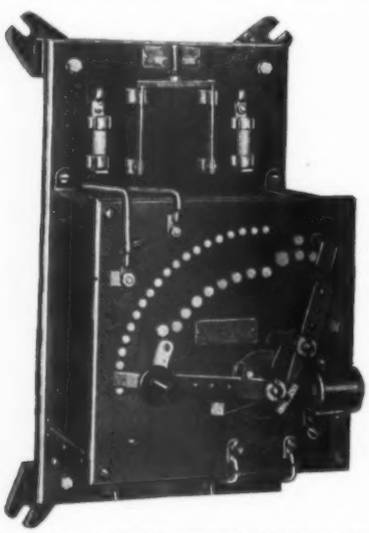
GENERAL ELECTRIC SPEED CONTROLLER.

Absolute reliability is a feature of the General Electric Company's CR 162 speed controller. Very often the control of shunt-wound direct-current motors is accomplished by the use of two rheostats, one for starting the motor and the other for varying the motor field current for speed control. In the CR 162 speed controller these two rheostats are combined in one box and operated by the movements of one and the same rheostat arm.

This device consists of a starting

rheostat, the arm of which is provided with a projection carrying a sliding contact which moves over the contact buttons connected to the field resistance. An auxiliary arm on the right hand side of the rheostat front serves to maintain a short circuit on the field resistance during the period of starting the motor, and on the starting resistance, when the arm is turned back to vary the running speed of the motor by regulating the field current.

When starting the motor, the starting arm can not be left in any position on the contact buttons, due to the action of a spring, but must be turned to the right until it engages the auxiliary arm forcing the latter to be retained by the no-voltage release coil. The auxiliary arm then withholds the spring actuating the starting arm and thereby makes it possible to leave the



UNIVERSAL SPEED CONTROLLING PANEL.

arm in any position on the field contacts which will give the desired speed control of the motor. If the operator releases the rheostat arm at any position while it is being moved to the right during the starting period, it will immediately return to the off position. Upon failure of voltage the retaining coil is demagnetized, releasing the auxiliary arm, which in turn releases the spring which carries the starting arm to the off position, thus opening the motor circuit.

The rheostat is so designed that it requires a little extra pressure to move the arm beyond the maximum speed point, the object being to call the operator's attention to maximum speed position so that he will not unintentionally shut down the motor. When it is desired to stop the motor the switch arm is thrown to the off position, de-energizing the retaining magnet and releasing the auxiliary arm.

Type CR 163 starting and speed controlling rheostats are the same as CR 162 with the addition of an over-load release coil.

Either controller can be supplied mounted on a slate base together with a double-pole switch and fuses and are then known as type CR 144 universal speed controlling panels.

Anderson Carriage Company Increases Plant Capacity.

Active work has begun on an addition to the plant of the Anderson Carriage Company at Detroit, Mich., made necessary by the company's venture into the commercial field, and the constantly increasing demand for its Detroit Electric pleasure cars.

The new building will be of reinforced concrete, three stories and basement, 304 feet front and eighty feet deep, affording an addition of about 100,000 square feet to the seven acres of floor space available in the present buildings.

The Anderson Carriage Company is now in the fourth season of its manufacture of electric cars. The 1910 schedule calls for an output of 1,500 Detroit Electric pleasure vehicles and the possibilities are that this output will be increased.

The schedule for the 1911 season outlines a production of 1,000 electric trucks, ranging from 1,000 pounds upward in capacity, according to the uses to which they will be put. They will be equipped with the latest Edison batteries.

One Detroit firm has already placed its order for eight thousand-pound trucks and two of 2,000 pounds capacity, with delivery-wagon bodies; and by early fall the company expects to be able to deliver trucks of this type in numbers.

Since its purchase last summer of the Elwell-Parker plant in Cleveland, the Anderson Company has had the largest facilities for the complete manufacture of electric cars in the United States. Every part that goes into the standard equipment of the cars, with the exception of the imported bearings and the wheels, is designed, fitted and assembled in its factories.

Consolidation of Vacuum-Cleaning Interests.

The McCrum-Howell Company, New York, N. Y., which manufactures the "Richmond" line of heating systems, bath tubs, lavatories and sanitary plumbing; "Richmond" suction cleaners and other specialties announces that it has succeeded in consolidating under the "Richmond" trade mark all the interests of the manufacturers of stationary vacuum-cleaning systems.

Vacuum cleaning has been passing through the various stages of evolution for some nine or ten years past, in the hands of a number of prominent inventors and manufacturers, each of whom had invented and patented certain features which differed from the others, but all of vital importance in the industry.

This modern sanitary necessity has been reduced to an exact and applied science along several lines, but it was found that in order to produce a strictly perfect system, it was necessary to combine the chief features of several systems.

The consolidated company is now in a position to place the manufacture of stationary vacuum cleaning systems on a business basis, and to eliminate the extravagance and waste through which stationary vacuum cleaning has been passing.

With all the experimental work done, with all of the early mistakes paid for, and with the whole engineering experience of the art at their command, they propose to bring the prices of stationary vacuum cleaning systems within the reach of all classes.

The McCrum-Howell Company now owns or controls eighty-five patents including not only the Kenney, Matchette and Lotz patents, but all other patents necessary to produce the most perfect and complete built-into-the-house vacuum-cleaning system.

All the companies building stationary systems under the old arrangements are retiring in favor of The McCrum-Howell Company, and these include the American Air Cleaning Company of Milwaukee, manufacturers of the famous "Aero" vacuum cleaning systems; Vacuum Cleaner Company of New York, manufacturing the Kenney line of patents, and the Sanitary Devices Manufacturing Company of Chicago, operating under the Lotz patents.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JUNE 4.—The Marconi Wireless Telegraph Company has given public notice that it is taking action against the United Wireless Telegraph Company of New York, and the British Radio Telegraph and Telephone Company for infringement of its patents. Both companies are charged with infringing Patent No. 7777 of 1900, and in addition, the former company is alleged to have infringed Patent No. 12326 of 1898, and the latter, Patents Nos. 10245 of 1902, and 4593 of 1907.

Patent litigation is also definitely threatened in connection with the Osram metal-filament lamps. The General Electric Company, of London, is taking proceedings against one of the agents in England for a metal filament made in Holland. The case is a test one in relation to the Osram patents, and should the General Electric Company be successful, a number of other firms will have to consider their position. While on the question of metal-filament lamps, it may be mentioned that the price of tantalum lamps has been still further reduced.

At a meeting of the National Chamber of Trade last week, the question of municipal versus State telephones was taken up with some degree of ardor. The publication last week of the Hull Corporation telephone accounts formed a convenient peg on which to hang the argument. These accounts pointed out that whereas the cost per station in Hull under the municipality was only $105, the cost of the Port Office systems was $260, and of the National Company's systems $150 per station. These facts, together with the knowledge that the subscription to the telephone service in Hull is lower than that of the Post Office or National Telephone Company, led to some strong comments upon State administration, and a plea that municipalities should be allowed to purchase their local telephone area from the Company in 1912, upon the same terms made to the British Post Office. But this is hardly likely to be the case.

Several instances have occurred lately in which municipal electricity committees have dealt in a very firm manner with what they have believed to be attempts to force up the price of cables and arc-lamp carbons. More than one order for cable has gone to a foreign firm, due to the action of the Cable Makers Association, which is avowedly a "ring" to keep up prices and share orders. It frequently happens that the tenders of the members of the association are within a few pounds or even shillings on orders extending into thousands of pounds, and rather than be at the mercy of the Association, municipal electricity committees, on the advice of their engineers and in the interests of economy, send the orders out of the country. A similar action has lately been tried by arc-lamp-carbon makers, although in this case, the effort is on the part of the foreigners, for England can boast of only one carbon factory. The carbon makers have failed equally with the cable makers, and for the same reason, that they have not been sufficiently united to get every maker into the ring. It is the outsiders who have been the cause of the failure of the scheme to force up prices.

The accounts of the Brush Electrical Engineering Company for 1909, show a very serious loss of over $100,000.

During the past year, the Institution of Electrical Engineers has made its rules for the professional conduct of consulting engineers more strict, and has brought them into line with those of the Institutions of Civil Engineers, which are admittedly very rigid. There are six rules which prevent the solicitation of work, and charging consulting engineers to act only in a strictly fiduciary manner. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JUNE 3.—An extensive pumping plant for the city water supply has been installed at Lyons, and the steam engines which were formerly used have been replaced by electric motors, at the same time adding a number of new motor driven pumps of large output. At present there are eight pump units installed at the Saint Clair plant and four units at the new plant of Grand Camp. This is designed to give a much needed increase in the water supply. Current for the motors is furnished by the Grenoble Power Company, using mains which are fed by four different hydraulic plants in the mountain region. The power steam engines will remain in place so as to serve as a standby. An extensive transformer station is now installed at Grand Camp, in which the different power lines are received.

In Holland there is a project on foot for an electric plant which will be used by the two towns of Zwolle and Deventer in common.

Wireless telegraphy is now being developed in Turkey, and the government is taking steps towards erecting six different wireless stations at Constantinople, Salonica, Beyrouth and other cities. It is intended to use these stations in connection with the battleships of the fleet, and these latter will shortly be equipped with wireless outfits for the purpose.

On June 1 the new regulations went into effect at Paris as regards the future operation of the city tramways upon a large number of lines. These include the compressed air, animal traction and autobus lines, but the electric lines lie outside of this combination. The use of transfer tickets has been discontinued, and each line is divided into two or more sections, with a reduced tariff for each section. The change in rates concerns both first and second class place. It is likely that this move will result in an increase of traffic upon some of the electric lines, as passengers who used transfer tickets upon the former lines will now take one of the electric tramways to complete the trip in cases where such combination will give a lower price.

A project is on foot in France for a light and power network which will cover the territory in the neighborhood of Rouen, and it is intended to promote the use of cement in this district. The site selected for the new power station is not far from the city, at the commune of Grand Ouevilly. It is expected that motors for industrial purposes will take a large amount of the supply from the station.

The municipality of Copenhagen is engaged upon a project for taking over all the city tramway lines, which are at present operated by private interests.

Matters are active in Germany as regards applying electric traction upon the Prussian state railroads. The first section which is to be equipped for this purpose lies between Dessau and Bitterfeld, and the railroad administration has already ordered the electric locomotives and other material for fitting out the line. On the state railroads it is intended to use the single-phase 10,000-volt system, working at fifteen cycles. The present locomotives are to have a single motor of 900 horsepower which will drive all the axles, these latter to be coupled by connecting rods.

The electric steel process is being introduced in Austria, especially for the manufacture of tool steel. At St. Polten there is now erected a Stassano furnace for this purpose and a second furnace of the same kind is being installed.

In Switzerland there is to be constructed a line of electric railroad which will run along the northern shore of Lake Thun and will connect Interlaken with Thun. A syndicate has been formed for promoting the enterprise.

The district in the neighborhood of Hilversum, Holland, is to have a light and power network erected in the near future. The project calls for a large electric plant which will be located between the above locality and the town of Buisum. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., JUNE 11.—The Saraguay Electric and Water Company is to issue $500,000 thirty-year bonds to provide for the completion of its lines in the suburbs of the city of Montreal.

The Dominion Light, Heat and Power Company has informed the city council of Montreal that, should the city decide to erect its own pole lines for street lighting, or to take over the lines and lamps of the Montreal Light, Heat and Power Company, it is now in a position to supply the required current. On the other hand, the company will operate the city's street lighting if desired.

An electric railway is to be built in the county of Compton, Que., in a circuit of a hundred miles for the development of certain sections which are rich in lumber and minerals, but are too far distant, at present, from railway facilities. The power will be taken from Lewis and Scotstown. A company has been formed with its head office in the city of Montreal.

It is announced that a public issue of five per cent bonds of the Sherbrooke Railway and Power Company, or Sherbrooke, Que., will be made this month. The company recently secured a new forty-year franchise, with exemption of taxation for twenty years, the city having the right to purchase the railway, as a going concern, at the end of twenty years.

The Shawinigan Water and Power Company, of Shawinigan Falls, Que., will hold a special meeting of shareholders at Montreal on the eighth of July next, to consider a resolution to increase the capital stock of the company from $7,000,000 to $10,000,000; also, to consider the adoption of certain measures to create and issue debenture stock to an amount not exceeding $500,000. The company's directors deem it advisable to undertake further development work at Shawinigan Falls, involving an additional production of 75,000 horsepower.

Notwithstanding all the difficulties and delays that have confronted the Ontario Hydroelectric Commission, in providing cheap electric power for Ontario, the scheme will come into actual realization in about six weeks' time, when power from the Ontario power Company's plant at Niagara Falls will be delivered through the commission's transformer station, to such municipalities in the province as are ready to accept delivery. W.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX.—An official order was issued suspending construction work on the electric railway that the Pachuca and Real Del Monte Mining Company was building to connect the Rosario mine with the Loreto hacienda. This action was taken on complaint of the Pachuca Light and Power Company which claimed that the construction of the road was an infringement on its rights.

The Mexican Tramways, Ltd., has finished the extension of its line to Xochililco, fifteen miles from this city. Test runs have been made and the new line will be formally opened July 2. The company is installing a transformer station at Xochimilco. This line has the longest single stretch of track of any in the company's system.

It is stated by Dr. F. S. Pearson, president of the Mexican Light and Power Company, who recently made a personal inspection of the construction work that is being carried on at Necaxa, that the company now has a storage capacity of 120,000,000 cubic meters of water at Necaxa and when the new dam is finished this will be increased to 190,000,000 cubic meters. It is expected that the dam will be finished this year. Next year another large dam will be constructed for the purpose of adding still more to the water-storage supply.

The Guanajuato Power and Electric Company, which is constructing an eighty-seven-mile transmission line to San Luis Potosi, will install a substation near the mining camp of San Felipe, where a contract for power has been made with the Providencia Mining Company. The double-circuit towers, six wires to the tower, are now being installed for this line. It is expected that the line will be finished by September 1. It will give the company a total of 188 miles of transmission lines from its Zamora hydroelectric plant. Transmission lines will also be built to the San Pedro mining district, state of San Luis Potosi, and to the Pinos district, state of Zacatecas. D.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

SURVEYING POWER SITE IN GEORGIA.—Surveyors are at present running surveys for the big power dam on the Ageechee River at Oliver, Ga. It is estimated that the plant will, when completed, develop 750,000 horsepower.

POWER TUNNEL IN CALIFORNIA.—The Mount Shasta Power Company of Redding, Cal., is boring a seven-mile tunnel, which will carry a quarter-million inches of Pitt River water across the big bend near Wengler. The water which flows in this tunnel will be sufficient for the development of about 100,000 horsepower.

NEW POWER PLANT IN OKLAHOMA.—A charter has been granted to the McKenna Power Development & Irrigation Company, of Ada, Okla., with a capitatl of $500,000. The company purposes to develop power from the Canadian River, operate electric interurban lines and irrigate lands in the vicinity of the plant. The incorporators are Dr. J. J. and Dell McKenna of Oklahoma City, J. E. Smith, M. L. Wall and A. H. Constant.

ALUMINUM COMPANY MAKES EXTENSION.—The Aluminum Company of America has planned to extend its power house at Massena, N. Y., allowing for development of 50,000 additional horsepower. This will mean an estimated expenditure of $750,000 in addition to the $12,000,000 already expended in installing the mammoth plant. The temporary dam is to be removed, and dredges operated by electricity from the power house are to do the excavating.

POWER DEVELOPMENT IN VERMONT.—A plan for power development which is under way on the Deerfield River, includes an eight-mile storage reservoir and a generating station where an 800-foot head may be available. The storage basin will be between Wilmington and Davis Bridge, Vt., a few miles from the Massachusetts line. The water impounded in the reservoir will be carried by a flume to Zoar, which is on the Deerfield River, south of the Hoosac tunnel. The power developed may be as much as 25,000 horsepower.

TO SUPPLY POWER TO THE SAN JOAQUIN VALLEY.—Capitalists of Los Angeles, Cal., have formed the Sierra-San Joaquin Electric Company with $5,000,000 capital, practically all paid up, for the development of power on the Tulare River in Tulare County, Cal. The concern will operate in connection with the Pacific Light and Power Corporation and the San Joaquin Light and Power Company in supplying electricity to the southern half of the San Joaquin valley. Eight hundred thousand dollars' worth of work has already been done by the company and $1,600,000 additional is to be expended within the year on the construction of the dams and an 8000-horsepower plant twenty-five miles above Porterville.

LIGHTING AND POWER.

(Special Correspondence.)

PEORIA, ILL.—The city council has ordered down all poles carrying any kind of current wires within the fire limits. Z.

MURFEESBORO, ARK.—The Little Missouri Water Power Company has been incorporated with a capital of $100,000. P.

MT. CARMEL, ILL.—The Mt. Carmel Gas and Electric Company has sold its construction department to J. Fred Stein & Sons.

DANVERS, ILL.—A thiry year franchise to light the streets of Danvers has been granted to the Traction Consumers' Light plant an auxiliary of the Illinois Traction system. Z.

DECATUR, ILL.—The Decatur Railway and Light Company will install a new 1000-kilowatt engine and generator, also a 500-kilowatt motor-generator set and two 500-horsepower boilers. Z.

CLINTON, N. C.—The Sampson Power Company, with headquarters in this town, has been chartered, capital stock $10,000, by C. W. Petty, B. P. Smith, and associates, to build and operate an electric power plant. L.

ELLOREE, S. C.—On June 23 the town of Elloree is to vote upon the question of issuing $10,000 worth of bonds for the erection of an electric-light plant and the construction of a waterworks system. Two separate elections are to be held.

EAST ST. LOUIS, ILL.—The Southwestern Light and Power Company of East St. Louis has been incorporated with capital stock of $25,000 to furnish light, heat and power. The incorporators are W. C. Haynes, T. W. Gregory and Fred Krouger. Z.

COLLINSVILLE, ILL.—The Collinsville Electric Company of Collinsville which recently was granted a franchise has been incorporated with a capital stock of $100,000. The incorporators are J. J. Frey of Hillsboro, A. W. Crawford and E. B. Hess. Z.

HANNIBAL, N. Y.—The Hannibal Electric Company has been incorporated to generate and sell electricity. The capital of the company is $20,000, and its incorporators are Theodore P. Ball, Ernest W. Rice, Chas. A. Cox, all of Hannibal, N. Y., and four others.

ELLENSBURG, WASH.—Articles of incorporation have been filed here for the Falls Power Company. The capital stock is given at $1,000,000. The company is empowered to develop and sell electricity for power and light, to deal in electric railroads and do a general electric business.

BOLTON LANDING, N. Y.—The Bolton Light and Power Company has been incorporated, with a capital of $25,000, to operate in Warren County. The directors are F. R. Smith, D. L. Rogers, S. G. Finkle and Henry E. Knoblauch of Bolton Landing, and Seymour Taylor of Glens Falls.

BIRMINGHAM, ALA.—It is the intention of L. Poole, mayor of Cuba, to secure the establishment of a hosiery knitting mill there. It is proposed to organize a $30,000 stock company, and in connection with the mill, develop a waterpower to operate the plant by electricity and furnish electric lighting for the town.

BANGOR, ME.—A new power house is being built on the Carrabassett River about three miles above North Anson village by C. O. Sturtevant of Farmington. A concrete dam is also being made and when completed will give a twenty-six-foot head. This plant will furnish power for mills and factories and also for lighting power in Farmington.

PARIS, KY.—Arrangements were recently completed for the absorption of the Paris Electric Light Company, by the Paris Gas Company, and the merger corporation will be under the presidency of A. M. Dolph, of Cincinnati, Ohio. The company will carry out the original plans for furnishing a daylight electric current for heating, fuel and light purposes, work being now in progress on the new plant to cost $20,000.

ATLANTA, GA.—The Georgia Power Company, recently bought the plant and equipment of the Etowah Power Company at a foreclosure sale, for $160,000. The Georgia Power Company has already secured permission from the railroad commission of Georgia to issue $6,000,000 of stock and $6,000,000 of bonds with which to pay for, develop and extend its various properties. It has also applied to the mayor and city council for a franchise to do business in Atlanta.

BEDFORD, IND.—The Bedford Power Company has recently decided to put in an auxiliary steam plant in connection with its hydro-electric plant at Williams, Ind., and has awarded the contract for the necessary machinery to Allis-Chalmers Company. This includes two 750-kilowatt, 2,300-volt, three-phase, sixty-cycle, steam-turbo generators, one fifty-kilowatt, 120-volt engine-driven exciter, one fifty-kilowatt motor-generator set and four 500-kilovolt-ampere oil-filled, water-cooled transformers.

GALENA, ILL.—A steam-driven power plant is being built here to transmit power twenty-five miles north into Wisconsin. The first two units installed will be 1,500 and 1,250-kilowatt three-phase alternating current generators driven by reciprocating Corliss engines. The current is generated at 2,300 volts, transformed to a line potential of 33,000 and reduced again to 2,300 or lower where necessary for local distribution. This plant will supply among other places the zinc mining center at Hazel Green.

ELECTRIC RAILWAYS.

(Special Correspondence.)

FRASER, IOWA.—The Fort Dodge, Des Moines & Southern Railway is installing improvements in its power house aggregating $65,000. C.

IOWA CITY, IOWA.—The Iowa City Electric Street Railway Company, capital $100,000, has been organized. D. A. Reese is secretary and treasurer. C.

ROSSMAN, TEX.—The Black Bayou Railway Company has been incorporated with a capital of $50,000 by S. H. Chatten, F. H. Brown, R. L. Trigg and others.

LOS ANGELES, CAL.—Robert Marsh has been granted a franchise for an electric street-railway on Thirty-ninth Street from Vermont Avenue to Western Avenue.

VALENTINE, NEB.—Chas. Cornell, president of the First National Bank, is projecting the construction of an interurban to Sioux City, Iowa, a distance of ten miles. C.

ATLANTA, GA.—The Southern Railway Company announces as a result of the success of experiments with gas-electric cars, two of which have been ordered, it is probable that their use on the line of the company will be further extended. B.

TRENTON, N. J.—The United Railways Investment Company, which controls the United Railways of San Francisco, with more than 250 miles of trolley lines, has filed an amended certificate here increasing its capital stock from $50,000,000 to $56,000,000.

ALBIA, IOWA.—The stockholders of the Albia interurban have authorized a bond issue of $300,000 for the extension of the line to Buxton, twelve miles north. The Engineering Construction and Securities Company, Chicago, has the contract for the work.

ALTOONA, PA.—At a meeting held by the new owners of the Altoona, Clearfield and Northern Railway, which extends from this city north twelve miles to Wopsonock, it was decided to change the name of the road to the Altoona, Junitia and Northern Railway and have the line electrified.

BROOKLYN, N. Y.—The Brooklyn and Jamaica Railway Company has been incorporated to operate a street surface electric railway from Montauk and Liberty avenues, Brooklyn, to Jamaica Bay. The capital is $100,000 and the directors include Horace J. Subers, Nelson S. Easton, Von Wein Edward S. Churchill of New York.

NEW ALBANY, IND.—The city council has granted a franchise to the Louisville & Northern Railway and Lighting Company to enter the city in North State Street. This road operates an interurban line over the Kentucky and Indiana bridge into Louisville and is preparing to extend the line to Paoli, French Lick and West Baden Springs. S.

INDIANAPOLIS, IND.—June 20 is the date set for opening the Indianapolis, Newcastle and Toledo line between Newcastle and Indianapolis. Connecting lines are being constructed on Brookside avenue. The members of the State Railroad Commission have inspected the line and say it is well built. The road will be named the "Honeybee Line." S.

MADISON, WIS.—President H. H. Zigler of the Cincinnati Construction Company, who hold the contract for the construction of the interurban road between Madison and Janesville, has stated that the line will be in operation by December. Contracts providing that the work must be finished within six months have been let by the construction company for the building of the road. M.

JANESVILLE, WIS.—The Janesville Electric Company has declared its intention of surrendering its franchise, purchased from the Thompson-Houston Company of Boston and granted to that company by the town of Janesville in 1885. The local company is to apply to the state railroad commission for an indeterminate franchise, under the new public utilities law of Wisconsin. M.

SHREVEPORT, LA.—The charter of the Mineral Electric Company, with $350,000 capital, having for its object the building and operating of a street and suburban railway, was recently filed. S. B. Cantey of Fort Worth is president; N. C. Blanchard, former governor of Louisiana, is vice-president, and W. C. Forbes of Fort Worth is secretary. Other incorporators are D. T. Bomar of Fort Worth and L. R. Smith of Shreveport.

GALVESTON, TEXAS.—The power plant of the Galveston & Houston Interurban Railway is to be built at Webster, which is located on the Galveston, Houston & Henderson road twenty-nine miles north of Galveston and about twenty-two miles south of Houston. There will also be three substations, one about eight miles south of Houston, another near Dickinson and the third between Texas City Junction and Virginia Point.

MT. CARMEL, ILL.—Articles of incorporation have been filed with the Secretary of State by the Evansville, Mt. Carmel & Olney Interurban Company. The capital stock is $30,000. It is the intention to establish an electric line from Mt. Carmel to Olney through Wabash, Lawrence and Richland counties. The incorporators, constituting the first board of directors, are: C. C. Seibert and S. J. Laubscher, Evansville, Ind., Thomas Marvell, and E. B. Sixler, Cynthiana, Ind.; Aden Knoph and J. F. Hyatt, Olney, Ill.; James Seibert and J. O. Smith, Lancaster, Ill., and Lewis Seitz, Mt. Carmel.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GREAT FALLS, MONT.—It is announced from New York that the Telepost Company will shortly establish connections with prominent points in Montana through St. Louis and Kansas City. C.

OCONTO FALLS, WIS.—The Morgan Telephone Company has been organized at Oconto Falls for the purpose of building a system of rural lines and connecting with the lines of the neighboring villages. M.

MILLEDGEVILLE, GA.—The Milledgeville Telephone Company, of which J. T. King is manager, is enlarging its system. Cables have been ordered and several lines are now being reconstructed. B.

WALDEN, N. Y.—The Walden Telephone Company has been incorporated with a capital of $30,000, to do a general telephone business. The incorporators are C. F. Fowler, A. J. Fowler and J. Oleva, all of this city.

JANESVILLE, WIS.—The Wisconsin Telephone Company will shortly commence the construction of a two-story vitrified-brick building, 70 feet by 30 feet, for an exchange. The cost will be about 15,000. The company will also expend $60,000 in remodeling the entire system. C.

VANDALIA, ILL.—The city council granted a franchise to the Fayette County Telephone and Telegraph Company, a merger of the Vandalia Telephone Company and the Central Union Company. Francises also have been granted at Shobonier and Brownstown. William Crouch of Vandalia is president of the new company. Z.

PETERSBURG, ILL.—The Petersburg Telephone Company has elected the following directors: H. H. Colby, J. S. Hurie, E. B. Overshiner, T. M. Scott, T. W. McNeeley, E. D. Boynton, William L. Wilms, J. H. Sullivan and A. D. Colby. Officers chosen were: President H. H. Colby; vice-president, T. M. Scott and secretary-treasurer, J. S. Hurie. Z.

GREENVILLE, ILL.—The exchange of the Bond County Telephone Company and the Central Union Telephone Company here have been consolidated under the name of the Bond County Telephone and Telegraph Company. Dr. A. . Keith of Greenville, will be president of the new company which has authorized an increase of capital stock from $43,020 to $73,020. E. E. Elliott is secretary. Z.

ELECTRICAL SECURITIES.

The speculation in stocks during the past week has been largely concentrated upon a few issues. Steel stands for more than a fourth of all the dealings, and with three others represents sixty-five per cent of the total. Of immediate importance to electrical as well as other interests was the increase in reserves of New York banks and the resulting ease of money, call loans during the last few days of the week being made as low as two per cent and funds for a period extending into next January being obtainable at four and one-half per cent or thereabouts. Loans of the clearing-house banks of this city in last Saturday's statement of their immediate position show a decrease of nearly $1,000,000, but the effect of recent liquidation is reflected in a decrease of more than $9,000,000 for the week in loans of trust companies. In general the outlook is excellent.

The Chicago Stock Exchange has listed $8,750,000 Western Electric first mortgage 5 per cent bonds.

The Saraguay Electric and Water Company is to issue $500,000 of thirty-year bonds to provide for the completion of its lines in the suburbs of Montreal.

Gross earnings of Boston Elevated, for May, were $1,288,990, an increase over the corresponding month a year ago of four and one-half per cent.

At the annual meeting of the Mexican Telegraph Company and the Central and South American Telegraph Company, directors were re-elected.

At the annual meeting of the Mexican Telegraph Company, H. H. Westinghouse, was elected a director to succeed the late Walter C. Kerr. All other directors were re-elected. Officers have also been re-elected.

The gross earnings of the United Railroads of San Francisco continue to show most gratifying increases, the daily average for thirty days of May, 1910, being $20,907, which is the largest May on record, with the exception of May, 1908, when the daily averages for the month was $21,065.

The Coney Island and Brooklyn Railroad Company has made application to the Public Service Commission for authority to issue about $500,000 worth of bonds. The bonds will probably bear interest at four per cent. The proceeds are to pay for improvements along Coney Island avenue, where it is proposed to remove the tracks from the side to the center and make a parkway on each side of the avenue. The original application was for $462,000. The application has been hanging fire for a year owing to an injunction which has now been removed. The company has paid no dividends for two years.

Earnings of Interborough Rapid Transit did considerably better in May than for the previous months. The May increase in gross averaged slightly less than $5,100 per day compared with an April gain of $4,100 per diem; total increase for the month was about

$155,000, compared with an April gain of $123,000 and a March increase of $196,000. The fiscal year ends the last of this month and for the eleven months to June 1 gross earnings of the New York subway and elevated system have gained $2,303,000 over the previous year, an addition of between nine per cent and ten per cent. Income from other sources will, however, be some $500,000 or $550,000 smaller than it was a year ago, so that if the final gain in gross for the full twelve months equals $2,000,000, the company will be doing exceedingly well. Interborough Rapid Transit carried 2,261,000 more passengers in May this year than a year ago.

DIVIDENDS.

Butte Electric and Power Company regular quarterly preferred dividend of one and one-fourth per cent and regular quarterly common of one and three-fourths per cent; the preferred payable August 1 to stock of record July 15; common payable July 1 to stock of record June 15.

Capital Traction Company; quarterly dividend of one and one-half per cent, payable July 1.

Cumberland Telephone and Telegraph Company; quarterly dividend of two per cent, payable July 1.

Holyoke Street Railway Company; four per cent, payable June 1.

Indianapolis Traction and Terminal; one per cent, payable June 30.

Louisville Traction Company; common quarterly dividend of one per cent, payable July 1.

Manhattan Railway Company; one and three-quarters per cent, payable July 1.

Nashville Railway and Light Company; two and one-half per cent on preferred, payable July 1.

NEW YORK.	June 13.	June 6.
Allis-Chalmers common	8¾	8
Allis-Chalmers preferred	29⅝	31
Amalgamated Copper	62	64
American Tel. & Cable	*80	*80
American Tel. & Tel.	134¼	133¼
Brooklyn Rapid Transit	76⅞	76⅞
General Electric	143½	141
Interborough-Metropolitan common	18¼	17⅞
Interborough-Metropolitan preferred	50½	48⅜
Kings County Electric	124	123
Mackay Companies (Postal Telegraph and Cables) common	87	84
Mackay Companies (Postal Telegraph and Cables) preferred	74⅛	75
Manhattan Elevated	133	132
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
U. S. Steel common	76⅝	76½
U. S. Steel preferred	115⅝	115
Western Union	61	64
Westinghouse common	59½	59½
Westinghouse preferred	*110	*110

*Last price quoted.

BOSTON.	June 13.	June 6.
American Tel. & Tel.	134¼	133¼
Edison Elec. Illuminating	248	248
General Electric	143½	141
Massachusetts Electric common	16½	16½
Massachusetts Electric preferred	80	86
New England Telephone	134	133
Western Tel. & Tel. common	15½	15½
Western Tel. & Tel. preferred	80	86

PHILADELPHIA.	June 13.	June 6.
American Railways	44	44
Electric Company of America	11⅜	11½
Electric Storage Battery, common	54½	57
Electric Storage Battery preferred	54½	57
Philadelphia Electric	14⅞	14¾
Philadelphia Rapid Transit	19¼	18
Philadelphia Traction	84	84⅞
Union Traction	46	46½

CHICAGO.	June 13.	June 6.
Chicago Railways, Series 1	50	50
Chicago Railways, Series 2	16	16
Chicago Subway	2½	2½
Chicago Telephone	116	116
Commonwealth Edison	112	112
Metropolitan Elevated common	21	16
Metropolitan Elevated preferred	61½	52½
National Carbon common	108	107
National Carbon preferred	117½	118

PERSONAL MENTION.

H. H. WESTINGHOUSE has been elected president of Westinghouse, Church, Kerr & Company, Limited, succeeding the late W. C. Kerr.

GEORGE B. FOSTER has been appointed Chicago sales manager for the Wisconsin Engine Company, and will have offices in the Fisher Building, Chicago.

SIR WILLIAM HENRY WHITE, for many years director of naval construction of the British Navy, has been awarded the honorary degree of D.Sc. by Columbia University.

LORD RAYLEIGH, well known in the world of physics, has been made a foreign member of the Berlin Academy of Sciences. He was previously a corresponding member of this institution.

DR. C. F. LORENZ, formerly of the Queen's University, Kingston, Ontario, has entered upon his duties as associate physicist in the physical laboratory of the National Electric Lamp Association.

JOHN M. KLEIN, general manager of Mathias Klein and Sons, Chicago, makers of linemen's and construction tools, is on a six weeks' business and pleasure trip to the Pacific coast. The demand for Klein tools is greater now than at any time in the firm's history.

MARTIN KUBIERSCHKY and SYDNEY H. MARCH, first and second vice-presidents of the United Railroads Investment Company of Philadelphia, which owns the United Railroads of San Francisco, have been in San Francisco consulting with the company's representatives in that city.

SHERMAN CULP, former vice-president and attorney for the Sandusky, Norwalk and Mansfield Railway Company of Ohio, has succeeded G. A. Bartholemew as president and general manager of the company. Mrs. Anna M. Stentz was re-elected vice-president, and C. B. Brooks secretary-treasurer.

C. H. CHALMERS, who has for several years been connected with the Electric Machinery Company, of Minneapolis, Minn., has recently sold his entire interest in that corporation. Mr. Chalmers entered the company in 1897, at which time it was run as a partnership. At the time of incorporation in 1902 he was made vice-president and general manager. Mr. Chalmers is taking a much needed vacation, but expects after a few months' rest to re-enter the electrical field.

M. E. GRASTON, who for five years has been district passenger and freight agent for the Indiana Union Traction Company and for fourteen years was connected with the Big Four railroad, has been appointed general manager of the Indianapolis, Newcastle and Toledo Traction Company. He assumed his new duties June 15, with headquarters in the Union Trust Company Building, Indianapolis, Ind. Mr. Graston was agent for the Big Four at Rushville, and at Wabash, Ind., prior to his connection with the Indiana Union Traction Company.

OBITUARY.

DR. HENRY GRAINGER PIFFARD, who was considered one of the foremost authorities in this country on dermatology and radium and radio-active substances, died on June 8 at his home in New York city, in his sixty-eighth year. He was born at Piffard, N. Y., on September 10, 1842, and was graduated at New York University in 1862. He practiced in New York city for nearly forty-six years.

CLINTON CHARLES BURR, chief engineer of the Northern Electrical Manufacturing Company, Madison, Wisconsin, died at Lincoln, Nebraska, May 28. Mr. Burr had been in failing health for some months past and in March last went to Lincoln for treatment, where his health improved for a time, but finally failed gradually until the end came. He was born at Albion, Michigan, December 30, 1870; prepared for college at the Albion high school and later entered the University of Michigan at Ann Arbor where he took the course in eletrical engineering. He then entered the employ of the General Electric Company at Schenectady and while still in their employ, went to Quito, Equador, where he superintended the installation and starting of a large hydroelectric plant, continuing in charge of its operation through the years 1899, 1900 and 1901. Returning to this country, he was identified for a period of one year with the Lincoln Traction Company, Lincoln, Nebraska, leaving there to enter the Engineering Department of the Ft. Wayne Electric Works at Ft. Wayne, Ind., where he remained until the year 1905. He then became chief engineer of the Phoenix Electric Company, Mansfield, Ohio, and later of the Mechanical Appliance Company at Milwaukee, entering the employ of the Northern Electrical Manufacturing Company at Madison in October, 1908. Very shortly thereafter he was appointed chief engineer of the company, which position he occupied at the time of his death.

PROPOSALS.

POST OFFICE, JEFFERSONVILLE, IND.—The office of the supervising architect, Washington, D. C., will receive sealed bids until July 1, for the construction, complete, (including plumbing, gas piping, heating apparatus, electric conduits and wiring and lift), of the United States Post Office at Jeffersonville, Ind., in accordance with drawings and specification, copies of which may be had from the custodian of site at Jeffersonville, Ind., or at the supervising architect's office.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

	Material	Quantity	Place of Delivery.	Schedule No.
June 21—	Cable, oil proof	20,000 feet	Washington, D. C.	2606
	Motors	2	Annapolis, Md.	2591
	Panels	3	Annapolis, Md.	2591
	Supplies, electrical	Miscellaneous	Annapolis, Md.	2591
June 28—	Bells, vibrating, etc.	100	Brooklyn, N. Y.	1620
	Circuits, call-bell and fire-alarm	Miscellaneous	Brooklyn, N. Y.	1620
	Cord, telephone	10,000 feet	Brooklyn, N. Y.	1620
	Fiber, reed, sheet	700 pounds	Brooklyn, N. Y.	1620
	Supplies, electrical	Miscellaneous	Brooklyn, N. Y.	1620
	Anodes, silver	418 ounces	Brooklyn, N. Y.	1620
July 5—	Supplies, electrical	Miscellaneous	Mare Island, Cal.	2601
	Searchlights, parabolic	20	Various	2584
July 19—	Equipment, electric elevating gun.		Works	2612

LEGAL NOTES.

CITIES MAY REGULATE BUT NOT PREVENT CONSTRUCTION OF TELEPHONE LINES.—The supreme court of Kansas holds, in New Hope Telephone Company vs. City of Concordia, 106 Pac. R. 35, that, under existing statutes of that state, the right to build a telephone line in and over streets and highways is directly granted by the state, and the mayor and council of a city are powerless to prevent such use. The council has the authority to provide by ordinance reasonable rules regulating the use of the streets and alleys for that purpose by defining where and in what manner a telephone company shall erect and maintain its fixtures. It is the duty of a telephone company contemplating the exercise of the right granted by the state to ask the mayor and council to prescribe reasonable regulations of the exercise of the right before placing any of its poles and structures on the streets and other public grounds of the city; but, if the mayor and council refuse to prescribe such regulations upon application, the company may build its lines upon the streets and alleys in such a manner as shall not incommode the public in the use of the streets and alleys so occupied, and the city authorities are not at liberty to treat the structures so erected as a nuisance.

DISCRIMINATORY CONTRACTS.—Discriminatory contracts between public utility corporations and their patrons which are held to be void as inimical to the public good, the supreme court of Wisconsin says, in City of Superior vs. Douglas County Telephone Company, 122 N. W. R. 1023, are so held because unreasonable advantage is thereby given to one customer or a class over others, whereas all have a moral and legal right to equality of treatment. In case of the contract being between a private corporation and the state or other public corporation, whatever advantage the particular customer has over general customers, obviously is to the benefit of the latter in the aggregate. In other words, in the ultimate there is no discrimination which is inimical to the public good, and hence no violation of public policy. Moreover, it is not every discrimination in the treatment by public service corporations of their customers which is condemned by the common law. Only unjust discriminations are so condemned. For special reasons, in the absence of any written law on the subject, such a corporation may make a different rate to one person than to another, or accept pay from one upon a money rate and from another in service of a legitimate character or some other reasonable equivalent, so long as the compensation demanded is within reason under the circumstances. Tested by these rules, a contract to maintain telephones free in public offices is not void for discrimination.

ILLINOIS COURT'S FIRST ROTTEN-POLE DECISION.—The supreme court of Illinois says, in De Frates vs. Central Union Telephone Company, 90 N. E. R. 719, that, so far as it is advised, no case has heretofore been presented to it growing out of the climbing of a rotten or decayed pole by a lineman. Cases of this character have been frequently decided in other states, and the rule uniformly applied is, that it is not the duty of the telephone company to inspect its poles below the ground and inform the linemen which are safe and which are unsafe to climb. In this case the lineman had had three years' experience as such, knew that no inspectors were furnished to go ahead of the linemen to examine the poles and inform them if they could be safely climbed, and knew that it was the uniform custom for the linemen to examine the poles themselves and determine whether they could be safely climbed. With this experience and knowledge he was as competent to determine whether the pole in question was safe as any inspector the company could have sent to examine the same. He must also have known that a pole will often stand when supported by wires and guy wires when it would fall of its own weight if unsupported. So, with all the knowledge that he has acquired in his three years' experience as a lineman, and the duty resting upon him to inspect for himself under the rules of the company, and with full knowledge that there had been no inspection made of this pole upon which he had a right to rely, he must be held to have assumed the risk of injury from the pole falling, and it was error to refuse to direct a verdict for the company.

NEW INCORPORATIONS.

HURON, S. D.—The Reed Electric Company has been incorporated with a capital stock of $200,000. P.

ATLANTA, GA.—The Atlanta Electrical Machine Company, capital stock $9,000, has been organized by A. J. Redwine and others. B.

NEW YORK, N. Y.—The Fred W. Nason Company has been incorporated in the State of New York to deal in electrical devices, etc. The company is capitalized at $10,000.

WILMINGTON, DEL.—The Goddard Telegraph and Transmitter Company has been incorporated with a capital of $500,000 by F. M. Blake, W. L. Sanders and J. A. Brierley, New York City.

MONTGOMERY, ALA.—The Electrograph Company, with capital stock of $7,500, has been organized by Warren B. Buxton and others to manufacture and install illuminating electrical signs. B.

MILWAUKEE, WIS.—The Holt Electric Company of Milwaukee has been incorporated with a capital of $30,000. The incorporators are: Charles W. Holt, Hatly P. Holt and Edward W. Timm.

NEW YORK, N. Y.—The Trolley Automatic Lock Company has been incorporated by J. H. Taylor, A. B. Warwick and A. A. Meeker, of New York, to manufacture automatic locking divices for trolley poles and other patented articles. The capital is $200,000.

EAST ST. LOUIS, ILL.—The Broderick-Bolte Electrical Company has been incorporated with capital stock of $15,000 to do a general electrical construction business. The incorporators are Frank B. Bolte, Charles F. Broderick and George Chartrand. Z.

NEW YORK, N. Y.—The Manhattan Electric Sign Company has been incorporated to manufacture and deal in electric and gas advertising devices and signs. The company was incorporated by S. Brown, H. W. Dietrich and G. N. Study, and is capitalized at $250,000.

BLOOMFIELD, N. J.—The Farkas Tungsten Lamp Company has been incorporated to manufacture electrical apparatus, tungsten lamps, etc., with a capital of $200,000. The incorporators are: W. W. Wilson, Pearl River, Rockland County, N. Y.; D. T. Gately, Brooklyn, and N. G. Wells, Penn Yan, N. Y.

NEW YORK, N. Y.—The International Electric Protection Company has been incorporated to manufacture electric signalling systems. The capital is $5,000,000 and the directors are Frank Rhodes, S. H. Freund, A. M. Trueb, J. J. Quinlan, New York; Roberts Walker, Scarsdale; H. M. Sloan, Douglaston, L. I.; F. A. Smith, East Orange, N. J.

EDUCATIONAL NOTES.

ARMOUR INSTITUTE OF TECHNOLOGY.—The bulletin of Armour Institute of Technology contains a complete list of the studies offered at that school, together with a report of the facilities. This bulletin is designated as the "General Information Number."

THOS. S. CLARKSON SCHOOL OF TECHNOLOGY, Potsdam, N. Y., held its eleventh annual commencement from June 12 to 16. The address at the exercises was delivered by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York city.

WORCESTER POLYTECHNIC INSTITUTE, Worcester, Mass., held its commencement exercises a short time ago. The engineering shops and laboratories were open for inspection and several social events took place. Among addresses given to the graduates was one by Dr. A. D. Risteen, editor of *The Locomotive*, on the subject "What Things Are Worth Doing."

NEW PUBLICATIONS.

MINERAL PRODUCTION OF CANADA.—The department of Mines of Canada has issued its report on the mineral production of Canada for the years 1907 and 1908. Complete tables are given regarding the production and value of various metals and minerals.

ELECTRIC TRACTION CITY AND SUBURBAN RAILWAYS.—Under this title *The Tramway and Railway World*, London, Eng., has reprinted an article by H. M. Hobart. The subject is treated very thoroughly, and a number of curves, charts and drawings aid, presenting the mater clearly.

FORTSCHRITTE DER ELECTROTECHNIK—The third section of the Fortschritte der Electrotechnik for 1909 has appeared and contains the usual subject index of periodical literature and potent issues, with abstracts of the more important original articles. It is published by J. Springer, Berlin.

COMPARATIVE TRIALS OF SCOUT CRUISERS.—The pamphlet under this title is the result of a board appointed to make tests of the United States Ships Birmingham, Salem, and Chester. The report embraces an analysis of the results obtained, together with a copy of the data recorded during the various tests made.

JOURNAL OF THE WORCESTER POLYTECHNIC INSTITUTE.—A number of interesting articles appear in the May number of this publication, among which is one relating to the testing of water wheels after installation, by Charles M. Allen. The tests are fully described, and a number of curves are given.

CHICAGO.—The Chicago Association of Commerce has published this book for the purpose of calling attention to the many advantages; industrial, commercial and financial, of the city of Chicago. The facts in the publication were collected and the book written by George E. Plumbe, statistician of the Chicago Association of Commerce.

THE TECHNOLOGY REVIEW.—The April issue of this quarterly magazine, published by the Massachusetts Institute of Technology contains, among other articles one entitled "Technology and the Public Health," which relates to the part that the Institute is taking in conserving life and health. The two illustrations, that of James Phinney Munroe and Prof. William T. Sedgwick, are excellent.

PROCEEDINGS OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION—The Proceedings of the Seventeenth Annual Meeting of the Society for the Promotion of Engineering Education, held at New York one year ago, has been issued by the secretary. This volume contains some valuable papers dealing with the relations of the engineering colleges and graduates to the industries.

CHART FOR THE CALCULATION OF THE SIZE OF COPPER CONDUCTORS IN TRANSMISSION LINES.—This booklet, which is a reprint of an article by L. A. Herdt, that appeared in the *Electrical World*, gives a complete method for the calculation of the size of wire to be used in transmission lines. Several examples are given and the results worked out in order to aid in the explanation.

OBSERVATIONS MADE BY COAST AND GEODETIC SURVEY.—The Department of Commerce and Labor has issued a bulletin containing the results of observations made at the Coast and Geodetic Survey Magnetic Observatory near Honolulu, Hawaii, in 1905 and 1906. Complete tables are given of the values of declination, horizontal intensity, vertical intensity, etc. Records which were made of earthquakes are also included in the report.

THE COST OF LIVING TO RAILWAYS.—This publication, written by Edward W. Harden, at one time financial editor of the *Chicago Tribune*, is a reprint of an article which appeared in *The Outlook* of April 9. Mr. Hurden tells of some of the effects which the present high prices have had on the railroad companies, and brings out the point that railway companies can often do less to help themselves than can the poorest of their employes. Several rather interesting tables are given to show the increase in wages and the prices of railroad supplies.

ENGINEERS' ISSUE OF THE WEEKLY HIGHLANDER.—The engineering students of Highland Park College, Des Moines, Iowa, made a very creditable job when they took hold of the student publication, *The Weekly Highlander*, for a special Engineers' Issue on May 11. A number of good articles by members of the engineering faculty are included along with portraits of the authors and some views about the college and of some of the apparatus. A good account of the second annual engineering exhibition was also given and some of the exhibits illustrated.

MASSACHUSETTS GAS AND ELECTRIC LIGHT REPORT.—The twenty-fifth annual report of the Board of Gas and Electric Light Commissioners of Massachusetts contains returns by sixty-seven incorporated gas companies, fifty-seven incorporated electric-light companies, and twenty persons or manufacturing corporations engaged in making or selling gas or electricity for light or heat. Returns have also been made by the proper officials of three cities and twenty-four towns owning municipal lighting plants. Results are compiled in the form of tables.

INDUSTRIAL ITEMS.

THE FOSTORIA GLASS SPECIALTY COMPANY, Fostoria, O., has mailed to its customers an attractive calendar for the month of June and one for July. To each calendar is attached the picture of a girl.

THE WALLACE BARNES COMPANY, Bristol, Conn., is sending out blotters advertising its flat and wire springs. This company makes springs of every description from steel, brass and phosphor bronze.

THE MATHIAS-HART COMPANY, 514-516 Atlantic Avenue, Boston, Mass., has been appointed the New England agent for the Lord Manufacturing Company. Through this new agency the Lord Manufacturing Company will be able to give much better service to its New England patrons.

WESTINGHOUSE, CHURCH, KERR & COMPANY, consulting engineers, have put through a contract between the Worcester (Mass.), Electric Light Company and the American Ship Windlass Company, of Providence, R. I., for six seven-retort stokers, each of which is to be used with a 600-horsepower Stirling Boiler.

THE REYNOLDS ELECTRIC FLASHER MANUFACTURING COMPANY, Chicago, Ill., describes in bulletin No. 11, some types of the Reynolds flasher which are on the market. In a folder on wiring, etc., which accompanies this bulletin, a good deal of information is given regarding the mechanism of these flashers, and the method of wiring the lamps in the electric sign.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has received an order from the Cananea Consolidated Copper Company, of Cananea, Sonora, Mex., for six McDougall furnaces. These are exactly like the four furnaces which the company now has in service. The furnaces have an outside diameter of eighteen feet six inches and are thirty-two feet high. They are the six-hearth type.

THE NATIONAL X-RAY REFLECTOR COMPANY, Chicago, Ill., is sending out bulletins from time to time containing illustrations and information of value to customers and those interested in illumination. With the most recent bulletin cards have been sent illustrating the lighting of the Shirley Hotel, Denver, Col., the Knight Locke Music Company, Denver, and the Denver Athletic Club.

THE MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass., has issued a large and complete catalogue for reference in the line of tools which it manufacturers. Especial mention is made of the "Twentieth Century" drill, and a number of new tools are illustrated. In connection with this catalogue the company is mailing a "Young Machinists Practical Guide," which contains much useful information and data.

C. W. LEAVITT AND COMPANY of New York, announce that English patent No. 22073, granted October 13, 1903, to F. W. Green and T. Prescott, covers alloys consisting of seventy to ninety parts aluminum, eighteen to five parts magnesium and twelve to two parts cadinium, and is recommended instead of electroplated ware for ornamental work, electric instruments, carriage fittings, gongs, aeroplanes and for all work where light castings are required.

THE HARRISON ENGINEERING COMPANY, of New York city has received among other contracts one to install the complete heating and ventilating system in the new car shops of the New York, New Haven & Hartford Railroad Company, at Middletown, Conn. The following buildings will be heated without the use of steam by the Harrison Aertube Heater System: Car storage plant, paint shop, blacksmith shop, wash room, storage room, and conductors' and motormen's room.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., has issued its June number of *Graphite*, which contains a number of interesting articles on various topics. A full page illustration of a steel building under construction gives an idea of some of the uses to which Dixon's Silica-Graphite Paint is put. The steel work of the building shown was painted entirely with this paint. Another illustration; that of the John Hancock Building in Boston, shows the location of the Company's Boston office.

THE FEDERAL ELECTRIC COMPANY, Chicago, Ill., is sending out the June issue of the *Federalist*, an attractive little publication dealing with the Federal Company's products in a pleasing manner. The current issue contains descriptions of noteworthy installations of Federal clusters and fixtures; illustrated descriptions of Federal specialties including sockets, receptacles, etc., and Federal "Win-do-lites." The *Federalist* is attractively bound and in addition to the forgoing contains matter of general interest to the electrical trade.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., has just issued bulletin No. 5210, describing a new design of Hawthorn alternators. The bulletin describes in detail alternators for belt, engine and water wheel drives, with and without direct connected exciters. This bulletin contains more than the usual number of illustrations and shows in detail the steps taken in the building up of the various parts of the alternators described. It shows illustrations of parts of the whole as well as photographs of the completely assembled machine. The reading matter describes rather fully the merits of and the reasons for the several kinds of construction used throughout the lines of alternators described therein.

THE CUTTER COMPANY, Philadelphia, Pa., has ready for distribution a handsome book, of 125 pages, devoted to the subject of automatic, instantaneous protection for motors and motor-driven machinery. The book is cloth bound, contains numerous illustrations and the quality of paper used is of the best. Included in the table of contents may be mentioned the following: The I. T. E. circuit-breaker and fuse compared; answer to the question: What is a 'Laminated' circuit-breaker?; the operation of an I. T. E. circuit-breaker; table of capacities of circuit-breakers best adapted for direct-current motors of given size and voltage; overload and "no-voltage"; protection of polyphase motors; generator and switchboard problems and price lists and wiring diagrams.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., is mailing an attractive booklet entitled "The Story of the Storage Battery." The booklet deals with the growth of the manufacturing company and the development of the product. A number of the users of the "Chloride Accumulator," "Tudor Accumulator" and "Exide" batteries are mentioned and attention is called to the fact that the electrical energy in over 1,000 telephone exchanges is supplied from the "Chloride Accumulator." Another publication, "How to Light Your Home by Electricity," sent out by the same company, gives much valuable information on the arrangement of small gasoline-engine driven lighting generators. A novel feature of the publication is a double page illustration showing the lighting installation on a farm.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., is distributing bulletin No. 4022, entitled "Lighting Transformers," which calls attention to some new features of design. These transformers are built very substantially and will stand the strains ordinarily met with. The small sizes are of cast iron, while the larger are built with corrugated steel cases. All transformers are guaranteed to carry ordinary overload not exceeding twenty-five per cent for two hours, and each one is tested at 150 per cent load for twenty minutes, to make sure that temporary excessive loads will not injure it. These transformers have five and ten-percent taps on the primary winding; an arrangement that makes it possible to furnish current at the same voltage either near the generating station or at distant points. This obviates the necessity of carrying transformers of different ratios, or of furnishing lamps of different voltages for different sections of the city. The transformers are so built as to give either 220 or 110 volts secondary when connected to a 2200-volt line. They may also be connected for 440 volts secondary making it possible to use the same transformer for either power or lighting service. With this make of transformer, therefore, it is necessary to carry only one type.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a number of bulletins relative to the electric-power industries, and of interest to the trade in general. Among these is bulletin No. 4738, entitled "Belt-Driven Revolving-Armature Alter-

nators," which describes three sizes of polyphase, sixty-cycle generators for use in small isolated plants. These generators are of the belt-driven revolving-armature type, and are designed for service at any power factor between .8 and 1.0. They range in capacity from seven and one-half to twenty-five kilowatts, and are furnished for 120, 240, 480 and 600 volts. Bulletin No. 4737, illustrating and describing an electric hardening furnace designed for the hardening or tempering of tool steel, contains considerable valuable data. In bulletin No. 4736, entitled "Lightning Arresters," are described various types of arresters for alternating and direct-current, high and low-voltage circuits. These arresters are described and illustrated in considerable detail, and the publication will be of interest to central station managers. Bulletin No. 4727 illustrates and describes in more or less detail, two types of the General Electric Company's sewing machine motors, which may be easily applied to any of the standard sewing machines of either drop-head or stationary-head types. These motors are intended for ordinary domestic use, and are made for alternating and direct current of standard voltages. Bulletin No. 4742, entitled "Electric Drive in Grain Elevators and Flour Mills," describes the application of the induction motor to this work.

DATES AHEAD.

Master Mechanics' Association. Annual convention, Atlantic City, June 20, 21 and 22.

Association of Railway Telegraph Superintendents. Convention, Los Angeles, Cal., June 20, 21, 22, 23 and 24.

American Society of Civil Engineers. Annual convention, Chicago, Ill., June 21-24.

American Institute of Chemical Engineers. Semi-annual meeting, Niagara Falls, N. Y., June 22-24.

Society for the Promotion of Engineering Education. Annual meeting, Madison, Wis., June 23-25.

New York Street Railway Association. Annual convention, Cooperstown, N. Y., June 27 and 28.

American Institute of Electrical Engineers. Annual convention, Waumbeck Hotel, Jefferson, N. H., June 27, 28, 29 and 30.

American Society for Testing Materials. Annual meeting Atlantic City, N. J., June 28-July 2.

Canadian Electrical Association. Annual convention, Lake Rosseau, Ontario, Canada, July 6, 7 and 8.

American Society of Heating and Ventilating Engineers. Semi-annual meeting, St. Louis, Mo., June 30-July 1.

Southern Textile Association. Convention, Augusta, Ga., July 2.

National Electric Contractors' Association. Annual convention, Atlantic City, N. J., July 20, 21 and 22.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 26, 27 and 28.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

League of American Municipalities. Annual convention, St. Paul, Minn., August 23-26.

Pacific Coast Electrical Exposition. San Francisco, Cal. August 20 to August 27, 1910.

Colorado Electric Light, Power, and Railway Association. Next convention, Glenwood Springs, Col., September 21, 22 and 23.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 10-14.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) June 7, 1910.

960,249. PUMP-GOVERNOR. Telesphore J. Beaudette, Los Angeles, Cal. Filed June 2, 1909. Clutch members carried by one part of a divided plunger stem are electrically brought into engagement to lock the parts together.

960,269. SHOCK-ABSORBING AND CORD-ADJUSTING DEVICE FOR INCANDESCENT ELECTRIC LAMPS. George A. Burnham, Saugus, Mass., assigner to S. B. Condit, Jr., Boston, Mass. Filed Feb. 17, 1910. A wire bent into a spring form is provided at its extremities with spring hooks to grip the lamp cord.

960,275. RATE-INDICATING DEVICE FOR FLUIDS. Frederick N. Connet, Providence, R. I. Filed Dec. 21, 1908. The time of taking a reading is electrically recorded.

960,291. AERIAL ELECTRIC CABLE. Carl Emil Egner, Stockholm, and Reinhold Frithiof Fredriksson, Gottenborg, Sweden. Filed Dec. 1, 1908. A sheathed carrier for the cable is made integral with the sheathing of the cable.

960,304. WIRELESS TELEGRAPHY. Roberto C. Galletti, Rome, Italy. Filed Dec. 20, 1907. A closed oscillating circuit is used to accumulate energy which emitted periodically by an antenna, the duration of the emission of the energy by the antenna being continued until the emission reaches the steady condition.

960,306. REFLECTOR FOR INCANDESCENT LAMPS. Edgar A. Gillinder, Philadelphia, Pa. Filed Aug. 24, 1907. A combined reflector and insulating hood for incandescent lamps consists of one piece of opaque glass in the form of a hollow body circular in cross section and having a rounded periphery or rim and an arch form centrally perforated top terminating in a grooved tabular neck and an inwardly tapering centrally perforated base.

960,324. ELECTRIC SWITCH. Edward M. Hewlett, Schenectady, N. Y., assignor to General Electric Company. Filed Sept. 2, 1905. In the same circuit with a switch are a circuit breaker and an electroresponsive device for operating the circuit breaker, and an automatic device first opens the switch, then closes the circuit breaker, and finally closes the switch.

960,354. SELF-LUBRICATING BEARING FOR TROLLEY WHEELS. Albert M. Levering, Philadelphia, Pa. Filed June 15, 1909. The trolley-wheel journal has in it a special groove in which is located a wick dipping into an oil cup secured to the trolley harp.

960,361. ELECTROPNEUMATIC AIR-BRAKE SYSTEM. George Macloskie, Schenectady, N. Y., assignor to General Electric Company, New York, N. Y. Filed Feb. 1, 1910. The air valves are electromagnetically operated.

960,368. SUSPENSION FOR TRAIN-LIGHTING DYNAMOS. Joseph A. Misland, Bayonne, N. J. Filed Sept. 29, 1909. The carrying rails for the dynamo extending laterally from the casing of the machine are slidably supported on guides carried by the car truck and a bracket device extending outside of the beams of the truck.

960,377. INSULATION-JOINT. Andrew McLean, Detroit, Mich. Filed June 11, 1909. An insulation joint for electric fixtures comprises a headed tubular section adapted to be screwed upon a gas pipe, a similar section in axial alignment with the first-mentioned section, the section heads adjoining and having flat meeting faces oblique to the longitudinal axis of the joint and insulated one from the other, and a coupling uniting the sections and insulated from the section connecting with the gas pipe.

960,383. DYNAMO-ELECTRIC MACHINE. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company. Filed April 26, 1909. A dynamo-electric machine comprises an armature, three axially displaced sets of collector rings carried thereby, a set of conductors extending from rings of one outside set to rings of the other outside set, a second set of conductors extending from other rings of one outside set to rings of the central set, a field magnet forming two unipolar fields surrounding the armature on opposite sides of the central set of rings, and separate field coils for magnetizing the two fields, whereby the relative voltages induced in the two sets of armature conductors may be varied by varying the currents in the separate field coils.

960,409. ELECTRIC HEATER. James Charles Royce, Toronto, Ontario, Canada. Filed May 14, 1909. A heater coil is formed of a strip of metal wound in volute form, and a band encircles the coil and is clamped thereto and electrically contacts with the outer winding of the coil.

960,414. TWIN LAMP-SOCKET. Howard R. Sargent, Schenectady, N. Y., assignor to General Electric Company. Filed Aug. 21, 1909. A twin lamp socket comprises a base, two aligned screw threaded shells parallel therewith, and a trough-shaped cover fitting over the shells.

960,440. COMPENSATOR. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company, a Corporation of New York. Filed Feb. 10, 1908. A current-transforming device and an auxiliary coil of high inductance are placed in series, and means are provided for automatically cutting the coil out of circuit with a source of alternating current and substituting therefor a connection with the transformer.

960,449. DYNAMO-ELECTRIC MACHINE. Louis E. Underwood, Lynn, Mass., assignor to General Electric Company. Filed April 3, 1909. A fan is used for ventilating the machine.

960,450. SWITCH CONSTRUCTION. Hermon L. Van Valkenburg, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed June 22, 1905. A multiple switch.

960,458. TELEPHONE-REPEATER. Nathaniel G. Warth, Columbus, Ohio. Filed Dec. 14, 1908. A relay comprises a receiver and a transmitter in repeater relation and having as its actuating vibratory element or armature a freely oscillatory tongue or reed-like regulable vibrator for electomechanically associating the receiver with the transmitter, and dominating means for damping the tongue.

960,466. ILLUMINATING-BODY. Gustave Weissmann, Paris, France. Filed Jan. 8, 1909. Lamps may be illuminated according to certain predetermined groupings.

960,470. APPARATUS FOR ELECTRICAL SEPARATION. Hen-

ry Azor Wentworth, Newton, Mass., assignor to Huff Electrostatic Separator Company, Boston, Mass. Filed May 5, 1909. There are two electrodes, one a conveyor electrode, and the other an adjacent spray discharging electrode, and an insulated electroconductive shield is so disposed in relation to these electrodes as to intercept further lodgment of the spray upon material affected by the spray earlier in the conveyance of the material, and so as to produce, in opposition to the surface of the conveyor electrode, a material-repelling static field.

960,482. MULTIPLE-TELEGRAPH SYSTEM. Eugen P. Batzel, Buffalo, N. Y. Filed March 3, 1909. A multiple-telegraph apparatus comprises means for developing alternating currents of different intensities, means for transmitting the currents over the line, means for generating alternating currents of corresponding intensities to the currents sent over the line from the transmitting station, and signal-receiving means actuated by alternating currents of corresponding periods of intensity of alternation from the transmitting station and from the receiving station.

960,495. CURRENT-REINFORCING MEANS. Ralph C. Browne, Salem, Mass., assignor to John Abbott, Winchester, Mass. Filed May 25, 1907. A current retransmitting and reinforcing apparatus comprises a variable magnet having opposing fixed pole-pieces, a receiving or magnetization-varying coil around each pole of the magnet for varying its field, a variable-resistance medium, opposing movable polepieces or armatures in the fields of the fixed pole-pieces to impart pressure to both sides or faces of the resistance medium, and electrodes for the resistance medium so arranged in a line transverse to the lines of pressure of the movable pole-pieces on the resistance medium.

960,504. POWER-OPERATED SWITCH OR CIRCUIT-BREAKER. Herbert W. Cheney, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed Oct. 20, 1905. The contacts are quickly releasing by the falling of a weight which is elevated by an electric motor.

960,505. MULTIPLE-VOLTAGE SYSTEM OF MOTOR CONTROL. Herbert W. Cheney, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed Oct. 6, 1909. A controller is arranged to connect a motor armature to different sets of multiple-voltage mains, a switch is arranged to be operated to cut a resistance into the motor armature circuit when the armature connections are changed from one set of multiple-voltage mains to another, a latch holds the switch in the position in which the resistance is in circuit, and electromagnetically operated means are provided for releasing the latch.

960,531. PNEUMATIC-DESPATCH-TUBE APPARATUS. Edmond A. Fordyce, Boston, Mass., assignor to Lamson Consolidated Store Service Company, Newark, N. J. Filed Sept. 8, 1905. The air pump is driven by an electric motor, the control system for which is described.

960,553. ALTERNATING-CURRENT-TRANSLATING DEVICE. Lemuel Frederic Howard, Edgewood Park, Pa., assignor to The Union Switch and Signal Company, Swissdale, Pa. Filed April 25, 1907. Renewed Nov. 24, 1909. A relay comprises an energizing coil adapted at times to be traversed by alternating currents of different frequencies, a core having two magnetic paths each of which includes a set of poles and one set of poles has a larger end area than the other set, a vane within the influence of the flux traversing both of the magnetic paths, and means for causing the two fluxes to exert turning efforts on the vane in opposite directions.

960,559. TROLLEY FOR ELECTRICALLY-PROPELLED VEHICLES. James Kolin, Chicago, Ill., assignor of one-half to William E. Smith, Chicago, Ill. Filed May 24, 1909. Side guard levers are provided.

960,568. SPEED INDICATOR AND RECORDER. William N. Mitchell, Chicago, Ill., assignor to The International Textbook Company, Scranton, Pa. Filed July 25, 1906. Includes an electric time-recorder.

960,569. AUTOMATIC ALARM AND GAS-PRESSURE CUT-OFF DEVICE. Oscar Chas. Moon, Pittsburg, Pa. Filed May 24, 1909. A latch may be electrically released to permit a valve to shut.

960,586. SIGNALING SYSTEM. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, Sandwich, Ill. Filed Feb. 15, 1909. A telephone system includes selective signaling devices for calling substations, etc.

960,598. IGNITING SYSTEM FOR EXPLOSIVE-ENGINES. Frank W. Springer, Minneapolis, Minn. Filed Nov. 5, 1906. Includes co-operating main and auxiliary timers.

960,618. ELECTRIC-LAMP SUPPORT. Solon W. Bailhache, Vallejo, Cal. Filed June 2, 1909. A lamp socket is secured to a spring clamp, etc.

960,626. ELECTRIC SWITCH FOR INCANDESCENT-LAMP CIRCUITS. William Blacknell Crossland, De Soto, Mo. Filed Aug. 9, 1909. A liquid-operated variable-resistance switch.

960,631. WIRELESS SIGNALING. Reginald A. Fessenden, Brant Rock, Mass. Filed Oct. 10, 1907. Apparatus for wireless signaling comprises means for practically continuous generation of electromagnetic waves, means at the receiving station for producing a continuous flow of impulses and means for normally annulling their effect by impulses received, except when the normal character of the sent impulses is altered.

960,654. PUSH-BUTTON. Dimnitt R. Lovejoy, Irvington, N. Y., assignor to U. S. E. M. Co., New York, N. Y. Filed March 8, 1907. A very simple form of spring-retracted push-button switch is described.

960,668. MAGNETIC SEPARATOR. Walter B. Moore, Seattle, Wash. Filed Aug. 31, 1906. A magnetic separator comprises a rotating magnet, means for directing material into the magnetic field thereof, a permeable member in the field at the upwardly moving side of the magnet, conveying means extending about the magnet for transporting materials attracted by the magnet into the field of force of the member, and a support extending outwardly from the member on which the materials attracted by the member are impelled in an outward direction by the magnet.

960,681. ELECTRODE FOR WELDING, ETC. William A. Neff, Cleveland, Ohio, assignor to The Electric Railway Improvement Company, Cleveland, Ohio. Filed Nov. 20, 1907. A block of carbon secured to and projecting from a holder is laterally surrounded by a coating of asbestos composition, and a number of independently removable bands hold this coating in place.

960,683. SYSTEM FOR THE GENERATION AND DISTRIBUTION OF ELECTRIC CURRENTS. Roger M. Newbold, Chicago, Ill., assignor to The Adams & Westlake Company. Filed July 9, 1908. A system for the generation and distribution of electricity comprises a self-exciting dynamo, means for regulating the field circuit thereof comprising an electromagnet in series with the main circuit, the coil of such magnet comprising a plurality of branches, and means for connecting such branches either in series or parallel.

960,723. ADJUSTABLE BRACKET. Theodore Smith, Chicago, Ill. Filed Sept. 17, 1908. An adjustable bracket comprises a swinging arm, an eccentric frictional part fixed to and moving with the arm, a movable part elastically mounted and separate from the arm and having contact with the eccentric frictional part.

960,731. TELEPHONE-RECEIVER. Walter F. Taylor, Brookline, Mass., assignor to Holtzer-Cabot Electric Company. Filed Aug. 8, 1908. The receiver includes a casing provided with a cap and diaphragm adapted to be secured to the open end of the casing; an electromagnet contained in the casing; a supporting member of insulating material located between the diaphragm and the base of the electromagnet, thereby affording a space within the casing for the leading-in wires; switch terminals mounted on the outer surface of the support; a switch also mounted on the outer surface of its support and adapted to bridge the terminals; and an actuating device for the switch extending through the wall of the casing.

960,734. VOLTAGE-REGULATOR. William I. Thomson, Newark, N. J., assignor to The Safety Car Heating & Lighting Company. Filed April 15, 1905. The field windings of a motor (connected to an operating variable resistance) are alternately short-circuited in accordance with variations in the field strength of a voltage-controlled magnet bridged across the mains of a source of current and in parallel with a current-utilizing device also bridged across the mains.

960,744. ELECTRIC-CONDUIT FITTING. John C. Vogel, Philadelphia, Pa., assignor to The Fairmount Electric and Manufacturing Company, Philadelphia, Pa. Filed Jan. 17, 1907. An electric conduit fitting comprises a hollow body having a substantially circular opening therein, tubular branches integral with this body and angularly disposed relative to each other (the circular opening facing the openings of the branches), a removable closure for said opening, and an inwardly rounded portion on the body between the branches, whereby wires may be drawn through the body without injury.

960,752. SPARK-PLUG FOR EXPLOSIVE-ENGINES. Joseph P. White, Savannah, Ga., assignor of one-half to Alexander P. Solomon, Savannah, Ga. Filed May 11, 1909. A spark plug has a portion provided with a cavity and a circuitous passage leading from the cavity.

960,757. ELECTRIC-VALVE-CONTROLLER. Alonzo T. Wilson, Des Moines, Iowa, assignor of one-half to William H. Nicholas, Des Moines, Iowa. Filed June 8, 1908. This device includes a gas burner, a valve therefor and a pilot-light attachment, a plate fixed to the valve, lugs on the plate, a weighted arm pivoted to the valve and designed to engage the lugs, an electromagnet, an armature arranged in operative position relative to the magnet, a link connecting the armature and the weighted arm, and an adjustable spring for normally elevating the weighted arm.

960,761. TIME-CONTROLLED AND ELECTRICALLY-OPERATED SIGNALING SYSTEM. Frank W. Wood, Newport News, Va., assignor to Charles Cory and John M. Cory, New York, N. Y. Filed Aug. 25, 1905. This system comprises an electrically

operated indicator to indicate successive intelligences, a circuit including the indicator, electrically operated means for closing the circuit, a circuit including this means, a plurality of circuit controllers any one of which may operate to close the last-named circuit, and time-controlled means to operate the controllers to close the circuit, the period of operation of any one of the controllers being different from all the other controllers.

960,773. ELECTRIC FURNACE. Thaddeus F. Baily, Alliance, Ohio. Filed Sept. 7, 1909. An electric furnace comprises walls of nonconducting, heat-resisting material, arranged to form a heating chamber and provided with an opening constituting a means of access to the heating chamber, spaced electrodes extending across the heating chamber and arranged in a convergent position, the electrodes being nearer to each other adjacent the opening than at other points in the chamber, and resistance material located in the heating chamber and in contact with the electrodes.

960,774. SPEED-CONTROLLING DEVICE APPLICABLE TO ELECTRIC MOTORS AND GENERATORS. Dmitry Balachowsky, Paris, and Philippe Caire, Levallois-Paris, France. Filed May 8, 1907. An exciter winding having a varied cross-section is provided with a series of contact points any one of which can be connected to one pole of the armature by means of a branch contact. A variable resistance connected in parallel with the exciter winding is provided for regulating the amount of current flowing through the thickest portion of the winding.

960,776. ELECTRICALLY-OPERATED LOCK. Herbert S. Balliet, New York, N. Y., assignor to General Railway Signal Company, Gates, N. Y. Filed Oct. 18, 1909. A controller in the circuit is operated by a latch for the lever which is normally adapted to be locked by a magnetically operated bolt.

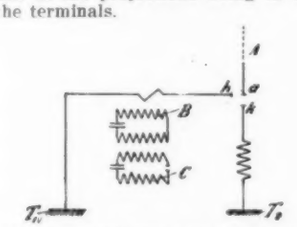
960,807. STREET-LAMP SOCKET. Clifton L. Bundy and Albert H. Manwaring, Philadelphia, Pa., assignors to Philadelphia Electrical & Manufacturing Co., Philadelphia, Pa. Filed Aug. 16, 1909. A lamp socket has an apertured base member, an internal shell having projections arranged to pass through the apertures and terminal contacts carried by the base member, one of the projections being in electrical contact with one of the terminals.

960,862. ELECTRIC FURNACE. John W. Evans, Belleville, Ontario, Canada. Filed July 15, 1909. An electric furnace comprises a chamber, a pair of electrodes adapted to produce an arc within the chamber, a separate pair of electrodes adapted to enter the material in the chamber, and means for individually operating the electrodes at will.

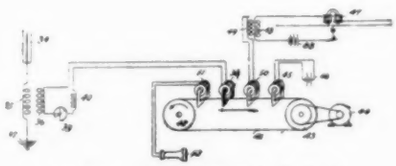
960,863. METHOD OF REDUCING REFRACTORY MATERIAL. John W. Evans, Belleville, Ontario, Canada. Filed July 15, 1909. The method consists in first applying heat to a body of material by an arc without the material to produce a molten mass, then cutting off such arc, and next heating the molten mass by passing electric current through a portion of the same.

960,875. BRUSH-HOLDER. Anton Freier, Boston, Mass., assignor to Holtzer-Cabot Electric Company. Filed July 13, 1908. A brush holder comprises a frame member having a clamp at one end for securing it to the machine, and an upwardly projecting arm at the opposite end combined with a brush-holding member consisting of an elbow lever pivotally connected with the frame member.

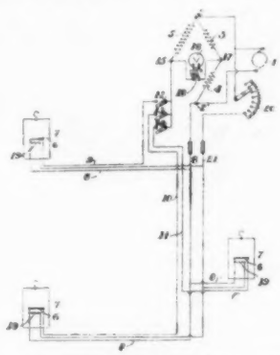
960,881. ALTERNATING-CURRENT MOTOR. Valere Alfred Fynn, London, England. Original application filed Dec. 19, 1906. Divided and this application filed March 6, 1909. In combina-



960,304.—WIRELESS TELEGRAPHY.



960,631.—WIRELESS SIGNALING.



960,823.—GAS-INDICATING AND MEASURING DEVICE.

960,808. INCANDESCENT-LAMP RECEPTACLE. Harry A. Badeau, Bridgeport, Conn., assignor to The Bryant Electric Company, Bridgeport, Conn. Filed Dec. 23, 1909. A recessed receptacle has automatic line-closing contacts located in the recess, and a co-operating independent lamp receptacle has a member in the lamp circuit adapted to enter the recess and engage and displace one of the line contacts.

960,823. INDICATING AND MEASURING DEVICE FOR USE IN MINES OR WHEREVER DESIRED TO DETECT PRESENCE OF COMBUSTIBLE GASES. Harold H. Clark, Pittsburg, Pa. Filed April 5, 1910. (Dedicated to the public). A detecting instrument for use in gas-testing systems comprises an inclosing vessel having a low specific heat and provided with openings at the top and bottom, wire-gauze coverings for the openings, an active element having a high negative temperature-coefficient suitably supported within the vessel, a heater supported immediately beneath the active element, electrical connections for the heater and active element, means for directing gas against the active element and means inclosing the vessel for protecting it from drafts while permitting a free circulation of the gas to be tested.

960,827. HANGER FOR ELECTRIC CONDUCTORS. James P. Conway and George Hoffman, Arnold City, Pa. Filed March 12, 1910. A hanger for electric conductors comprises a cup member interiorly threaded and provided on the closed end with a securing spike, a bolt (supported from the cup member and insulated therefrom) provided with a slotted outer portion, a supporting hook movable in the slot of the bolt, and a nut on the bolt supporting the hook and also constituting means to move the hook longitudinally of the bolt.

960,829. TROLLEY FOR ELECTRIC RAILWAYS. Clarence D. Coyle, Youngstown, Ohio. Filed Nov. 15, 1909. A trolley-harp mounting.

960,856. DIPLEX TELEPHONE CONNECTION. August Wilhelm Ebeling, Charlottenburg, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Filed July 7, 1909. In combination with the double lines, having a set of double coils forming the self-induction load according to the Pupin system, is an additional set of double coils alternating with the double coils of the first-named set along the lines at suitable intervals, the single coils of the two sets of double coils in one of the two lines being all traversed by the current in series and in the same sense and the single coils of the two sets located in the other line being traversed by the current in series but alternately in the opposite sense.

tion with an inducing member producing a transformer field, is an induced member having an exciting circuit producing a motor field and a working circuit, the working circuit being closed by way of brushes along an axis approximately coinciding with that of the transformer field. Means for producing self-induction in the exciting circuit only are disposed outside the inductive influence of both the transformer and the motor fields, and means are provided for varying the magnitude of the self-induction.

960,882 and 960,883. POLYPHASE COMMUTATOR-MOTOR. Valere Alfred Fynn, London, England. Filed June 1, 1909. There are at least two working circuits each containing a neutralizing winding on the stationary member and a commuted winding on the revolving member, the windings being coaxially connected in series relation, a separate adjustable ratio shunt transformer for connecting each of the working circuits to the source of supply, and a separate conductor for each working circuit provided with a movable contact and connecting the transformer feeding the circuit to a point on that circuit situated between the neutralizinz winding and the commuted winding.

960,884. ALTERNATE-CURRENT COMMUTATOR-MOTOR. Valere Alfred Fynn, London, England. Filed Nov. 26, 1908. An alternating current motor, comprises an inducing member provided with a main inducing winding and an auxiliary winding displaced therefrom and inactive at starting, an induced member closed by means of working brushes along an axis displaced from that of the main inducing winding, means for impressing a compensating electromotive force on the induced member along a second axis, and means for connecting the auxiliary winding in series relation with the main inducing winding.

960,896. CONTROLLER FOR ELECTRIC MOTORS. Emil Gruenfeldt, Cleveland, Ohio, assignor to The Baker Motor Vehicle Company, Cleveland, Ohio. Filed July 26, 1909. In connection with a motor having two series field windings is a controller having contacts arranged to connect the field windings

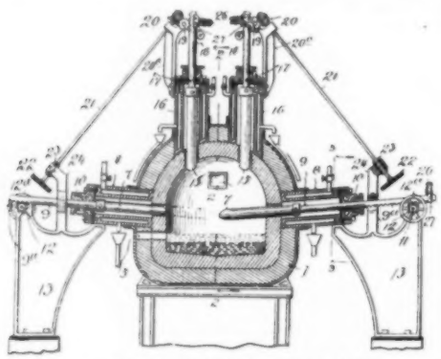
in series at one step; at the next step to place the resistance in parallel with the field windings, and at the third step to connect the field windings in parallel.

960,911. ELECTRIC-ARC LAMP. Henry William Headland, Leyton, and Frederick Plutte, London, England. Filed Oct. 28, 1907. An electric arc lamp comprises groups of inclined carbons, supports for the groups, means for rotating the supports to revolve the carbons and means for moving the supports to feed the carbons longitudinally.

960,925. COMBINED SYNCHRONIZING AND TELEPHONE SYSTEM. Gustav E. Hoglund, Chicago, Ill., assignor to William N. Selig, Chicago, Ill. Filed March 5, 1910. Electrical circuits are adapted to detect synchronism of two machines and means are adapted to permit the use of a synchronizing line for connecting a telephone transmitter to a telephone receiver.

960,928. POLARIZED RELAY. Winthrop K. Howe, Rochester, N. Y., assignor to General Railway Signal Company, Gates, N. Y. Filed May 19, 1909. The relay comprises a pair of electromagnets, a pair of permanent horseshoe magnets one around each electromagnet and having their like poles adjacent, a movable armature pivoted to and magnetized by one of the magnetic poles and extending toward the other magnetic poles, and a pole-piece attached to the latter magnetic pole and extending toward the armature.

960,962. METALLIC-FILAMENT ELECTRIC GLOW-LAMP. Hans Kuzel, Baden, near Vienna, Austria-Hungary, assignor to General Electric Company. Filed March 31, 1908. In combination



960,862.—ELECTRIC FURNACE.

with a horseshoe-shaped filament and supply wires to which the ends of the filament legs are fastened, are supporting means for the filament legs located at a point intermediate between the fastened ends of the legs and the apex of the filament, and the bight portion of the filament beyond the supporting means being bent on the latter, with means for supporting the said bight portion so bent.

960,970. AUTOMATIC CIRCUIT-BREAKER. Harry Ward Leonard, Bronxville, N. Y. Original application filed March 21, 1901. Divided and this application filed Feb. 19, 1907. Comprises two independently closable switches, means for opening each of the switches upon the occurrence of overload current, and means for automatically opening at least one of the switches upon the occurrence of reverse current, this means comprising two electromagnetic windings each having its respective magnetic mass.

960,971. MEANS FOR AUTOMATICALLY CONTROLLING ELECTRIC MOTORS. Harry Ward Leonard, Bronxville, N. Y. Original application filed Feb. 6, 1897. Divided and application filed Jan. 28, 1902. Divided and this application filed Nov. 7, 1907. There are two mechanically and electrically connected electromotive-force-producing windings, a counter-electromotive-force-producing winding supplied with energy therefrom and requiring in operation variable voltage impressed at its terminals, and means for automatically controlling the energy supplied to the counter-electromotive-force-producing winding.

960,995. LIFTING-MAGNET CONTROLLER. Jacob F. Motz, Pittsburg, Pa., assignor to The Electric Controller and Supply Company, Cleveland, Ohio. Filed Dec. 17, 1907. Includes magnetically and hand-operated switches, etc.

960,998. ELECTRIC-LAMP SUPPORT. Joseph Neple, Lyon, France. Filed Jan. 3, 1910. An electric-lamp support comprises a base, two pairs of diametrically opposed pivots carried thereby, one pair being in a plane perpendicular to the other, a slotted member rotatable about each pair of pivots, and a union engaged by the slotted members at the intersection.

961,025. ELEVATOR-ANNUNCIATOR. William W. Savage, Buffalo, N. Y., assignor of one-half to Robert Moderwell, Buffalo, N. Y. Filed Feb. 18, 1909. An electric signaling device for elevators.

961,033. CUP OR HEAD FOR MASSAGE DEVICES. Charles M. Siebert, Jr., Columbus, Ohio, assignor to The Siebert-Welch Company, Columbus, Ohio. Filed Aug. 3, 1909. A massage cup comprises a body portion a clamping member and a flexible diaphragm clamped between the body portion and the clamping member. A separate insulating ring member slips down over the clamping member, a pair of segmental contact plates separated from each other being imbedded in the insulating ring, and current conducting members lead through the ring from the rear face thereof to the contact plates.

961,036. ELECTRIC SIGNAL-SOUNDING APPARATUS. Alfred L. Sohm, Whittier, Cal., assignor to National Electric Works, Whittier, Cal. Filed Sept. 4, 1908. Comprises a plurality of rotative contact elements, a plurality of contact elements each adapted to be moved into and out of the path of movement thereof, and means to advance a selected group of said last named contact elements into the path of movement of said rotative contact elements.

961,050. HANGER FOR LIGHTING-FIXTURES. Ernest H. Wakefield, Vermilion, Ohio. Filed Nov. 6, 1909. An electrolier suspender.

961,056. SPARK-PLUG. Joseph M. Woods and John S. Maimone, Denver, Colo., assignors to The Compression Spark Plug Company, Denver, Colo. Filed May 6, 1908. A sparking apparatus for explosive engines comprises a hollow plug, a pair of contact members, means for operating the contact members by means of explosive mixture in the cylinder, means for varying the operating pressure of the explosive mixture, and means for locking the means consisting of a lever and movable sliding rod working in an orifice and secured by a set screw.

961,057. SPARK-PLUG. Joseph M. Woods and John S. Maimone, Denver, Colo. Filed March 16, 1909. A spark plug comprises a casing, a stationary contact, a movable contact, means for yieldingly holding the movable contact against the stationary contact, means for varying the pressure of the yielding means, and a cam for controlling the last-mentioned means.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired June 13, 1910:

499,254. ELECTRIC HOSE-COUPLING. Howard Sargent, Cambridge, Mass.

499,261. BURGLAR-ALARM SYSTEM. Alfred Stromberg, Chicago, Ill.

499,297. ELECTRIC GAS-LIGHTING APPARATUS. Thomas W. Lane, Boston, Mass., and Charles E. Lee, Chicago, Ill.

499,298. ELECTRIC GAS-LIGHTING APPARATUS. Thomas W. Lane, Boston, Mass.

499,305. ELECTRIC BELL. John L. Moore, New York, N. Y.

499,313. ELECTRIC MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

499,321. SYSTEM OF PROPELLING CANAL BOATS BY ELECTRICITY. Samuel W. Gear, Buffalo, N. Y.

499,350. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Horace F. Parshall, Lynn, Mass.

499,363. ELECTRIC SWITCH. James F. McElroy, Albany, N. Y.

499,374. CONDUIT ELECTRIC RAILWAY. William R. DeVoe, Shreveport, La.

499,411. ELECTRIC-SIGNALING APPARATUS FOR ELEVATORS. Charles G. Armstrong, Chicago, Ill.

499,428. ELECTRIC HINGE. William S. Hull, Sheffield, Ala.

499,461. OVERHEAD TROLLEY-WIRE SWITCH. Rudolph M. Hunter, Philadelphia, Pa.

499,470. SHADE-HOLDER FOR ELECTRIC LAMPS. Charles Remhof, Brooklyn, N. Y.

499,473. ELECTRIC LIGHT. Gaston Sautter, Paris, France.

499,518. METHOD OF ELECTRICALLY WELDING METALS. Charles L. Coffin, Detroit, Mich.

499,543. ELECTROMAGNETIC CAR BRAKE. John C. Henry, Westfield, N. J.

499,544. REGULATOR FOR ELECTRIC MACHINES. John C. Henry, Westfield, N. Y.

499,596. ELECTRIC-IGNITING DEVICE. William H. Russell and George E. Russell, Jersey City, N. J.

499,633. GEARING FOR ELECTRIC-RAILWAY CARS. John C. Henry, New York, N. Y.

499,646. SWITCH. George W. Russell, Jr., Denver, Colo.

499,657. METHOD OF AND APPARATUS FOR ELECTRICALLY WELDING SHEET METAL. Charles L. Coffin, Detroit, Mich.

499,664. ELECTRIC FUSE BLOCK. Thomas J. Fay, New York, N. Y.

499,681. ELECTROMAGNET BLANKET. Nils A. Renstrom, Omaha, Nebr.

499,693. SYSTEM OF WIRING MULTIPLE SWITCHBOARDS. Charles H. Wilson, Chicago, Ill.

499,610. RECORDER. John T. Todd, Newman, Ill.